New Canola Production Practices Challenge Researchers to Provide Defined Techniques to Producers

Burton L. Johnson, Patrick M. Carr, Eric D. Ericksmoen, Bryan K. Hanson, Neil Riveland
North Dakota State University
Department of Plant Sciences
Dickinson Research Extension Center
Hettinger Research Extension Center
Langdon Research Extension Center
Williston Research Extension Center

Summary

North Dakota's canola (*Brassica spp*) production has rapidly expanded since sizable acreage were planted in 1991. Concurrent with the rapid increase in canola production and grower numbers in North Dakota has been private and public technological advances providing new cultivars with broader adaptation, improved agronomics and expanded product diversity. The objectives of the study were to determine the agronomic and economic results of adopting herbicide-tolerant canola (HTC) cultivars and synthetic polymer seed coatings compared with conventional production systems. To do this, studies were conducted at Dickinson and other locations in North Dakota in 1999 and 2000. Agronomic and economic data were collected at most locations; however, environmental and other factors damaged the study at Dickinson before yield and other agronomic data could be collected in both years.

Introduction

Canada's canola production for the 1998 growing season was near the 14 million acre level, with slightly more than 50% associated with HTC production. Canadian producers access to production of HTC has been ongoing for several years and consequently the substantial acreage associated with HTC indicates the application, acceptance, and success of the technology. Canola growers in the United States, with North Dakota by and far the largest producer, will have limited access to HTC in the 1999 growing season. Canadian research regarding HTC indicates this approach to canola production can be greatly influenced by cultivar, weed pressure and spectrum, environment, and economics (Canola Council of Canada. 1997). When all these factors are considered a conventional approach (open-pollinated or hybrid cultivars with pre- and post-emergence weed control) to canola production is often the best option both agronomically and economically. Evaluation of HTC systems or their comparison to conventional systems has not been performed in North Dakota.

Kirkland and Johnson (1998) compared the performance of fall dormant-seeded canola with spring-sown canola in studies at several Canadian sites from 1993 to the present. Results show two to three weeks earlier maturity from fall dormant plantings compared to normal spring plantings. Seed yield, weight, and oil content were greater from fall dormant and early spring plantings than from plantings in mid-May. Better stand establishment was observed from fall dormant seeding into stubble than tilled fallow. Lack of surface residue in tilled fallow increases soil temperature fluctuations near the soil surface. This causes premature germination and seedling mortality in the fall or possible frost damage if seedlings emerge to early in spring. Surface residue also protects earlier emerging seedlings from wind and soil abrasion and provides a more favorable micro-climate for plant development.

Several early studies, with open-pollinated canola, indicated that seeding rate did not influence yield performance (Degenhardht and Kondra, 1981a; Christensen and Drabble, 1984). However other studies found greater yield produced at a seeding rate of 5.3 pounds per acre (Kondra, 1975, 1977; Degenhardht and Kondra, 1981b). Studies on1ater-deve1oped hybrid canola performance regarding seeding rate are limited. McVetty et al. (1988) suggested a 4 pound per acre seeding rate for hybrid canola while Deynze et al. (1992) suggested a 5.3 pound per acre seeding rate for both open-pollinated and hybrid cultivars. Current Canadian and North Dakota (Berglund and McKay, 1997) recommendations are to seed *B. napus* cultivars from 5 to 8 pounds per acre and *B. rapa* cultivars from 5 to 7 pounds per acre.

Recent investigation by Oelke and LeGare (1998) in Minnesota looked at seeding rate based on plant density. This approach basis seeding rate on seed number or plants per unit area and is more precise than seeding rates based on pounds per acre, especially given the large variability in cultivar seed size. High seed costs for hybrid canola and HTC and varying seed size require producers to be judicious but sufficient in determining seeding rates to achieve good crop performance. Increased seedling vigor was observed by Hanson and Lukach (1998) for hybrid cultivars compared to open-pollinated cultivars in canola variety trials conducted at the Langdon Research/Extension Center. Hybrid seed is larger than open-pollinated seed and has more stored energy for germination and emergence processes. This may enable hybrid seed to emerge from deeper planting depths than smaller seeded open-pollinated cultivars. Research in this area has not been reported. Current Canadian and North Dakota recommendations for canola planting depth are between [illegible] and 1 inch. Planting deeper than 1 inch delays and reduces emergence and increases exposure of emerging seedlings to soil pathogens.

Canadian research indicates *B. rapa* cultivars lend themselves better to straight harvesting than *B. napus* cultivars (Canola Council of Canada, 1997). This is primarily related to shattering differences between the species that occur prior to straight harvesting. Plant architecture, height, stem strength, canopy density, pod integrity, and environmental factors such as wind and precipitation are all involved in the severity of seed losses from shattering. Although *B. napus* cultivars are not recommended for straight harvesting unless swathing is not an option, there are reported instances where straight harvest of *B. napus* was successful. *Brassica napus* cultivars exhibit varying degrees of acceptance for straight harvesting and continued cultivar improvements for seed shattering may produce *B. napus* cultivars suitable for straight harvest in the future.

This research proposal seeks to provide valuable information to help producers be more successful in canola production and to realize greater on-farm profits. The objectives address evaluation of new technologies and alternative strategies in established and new canola production areas of North Dakota. Specific objectives are to: (1) evaluate and compare HTC, open-pollinated, and hybrid canola production, (2) evaluate dormant fall and traditional spring plantings of spring canola, (3) evaluate the effect of seed size, planting depth, and stand density on crop performance, (4) compare swathed and straight harvested canola production. Each objective will consider not only agronomic crop performance but also major economic differences associated with management alternatives.

Materials and Methods

Objective 1) Evaluate and compare HTC, open-pollinated, and hybrid canola production

A dryland field study was conducted at the Hettinger and Williston Research/Extension Centers to compare the performance of HTC, open-pollinated, and hybrid canola production systems. The study was a randomized complete block design (RCBD) with five replicates and five treatments. Treatments consisted of a cultivar selection for each canola type that indicated good agronomic performance. Trifluralin, a preplant incorporated herbicide, was used for weed control with Crusher and Hyola 401. The respective herbicide for the HTC cultivar was used according to company recommendations. Cultivars were sown at the same seeding rate based on germination and seed size differences. The targeted established stand density was 16 plants per square foot, which compares approximately to a 6 pound per acre seeding rate. Plots were approximately 6 by 25 feet with sufficient isolation to protect against spray drift from adjacent treatments. Plots had sufficient border on all sides to minimize border effects. Plots were harvested on a timely basis according to cultivar maturity.

Objective 2) Evaluate dormant fall and traditional spring plantings of spring canola

A dryland field study was conducted at the Dickinson Research/Extension Center to evaluate the concept of fall dormant seeding of canola. Factors in the study were planting date, tillage practice, and presence or absence of a polymer seed coating to delay germination. There were two levels for each factor: planting date (fall or spring) tillage practice (conventional or no-till), and seed coating (coated or non-coated). Four treatments associated with fall planting were: 1) fall planting/conventional-till/non-coated, 2) fall planting/no-till/non-coated, 3) fall planting/conventional-till/coated, and 4) fall planting no-till/coated. There were also four treatments associated with spring planting: 1) early spring planting no-till/non-coated, 2) early spring planting/conventional-till/non-coated, 3) normal spring planting/no-till/non-coated, and 4) normal spring planting/conventional-till/non-coated. The experimental design, with five replicates, was a split plot with tillage practice being the main plot and subplots a factorial arrangement of planting date and seed coating. Seeding rate was within the recommended range for canola production, 5 to 8 pounds per acre.

Objective 3) Evaluate the effect of seed size, planting depth, and stand density on crop performance

A dryland study was conducted at the Langdon Research/Extension Center to evaluate seed size, planting depth, and stand density on canola performance. The study was a RCBD in a factorial (2x2x4) arrangement with 16 treatments and five replicates. Small and large seed sizes represented an open-pollinated and hybrid cultivar, respectively. Planting depths were 0, 75 and 1.5 inches with targeted established stand densities of 5, 10, 15, and 20 plants per square foot. Planting occurred, under conventional tillage practices for seedbed preparation, within the optimum planting window based on site conditions and pending weather factors, Best management practices were applied regarding weed control, fertility, insect and disease management, and harvesting operations. Plots were approximately 6 by 25 feet with sufficient border to minimize border effects on plants for character determinations.

Objective 4) Compare swathed and straight harvested canola production

A field study conducted at Langdon and Prosper, North Dakota, compared agronomic performance when swathing or straight harvesting a *B. rapa* and *B. napus* cultivar. Swathed and straight-harvesting treatments occurred with and without application of an anti-shattering compound, 'Spodnam.' Timing of anti-shattering treatments was based on manufactures recommendations. The experimental design was a RCBD in a factorial (2x2x2) arrangement with five replicates. Best management practices were applied regarding weed control, fertility, insect and disease management. and harvesting operations. Plots were approximately 6 by 25 feet with sufficient border to minimize border effects on plants for character determinations. Percentage of green seed was determined from harvested treatment samples.

Objectives 1), 2), 3), and 4) Collected from plants within the plot interior, included stand establishment rating, seedling vigor, first flowering, end flowering, lodging, plant height, disease and insect incidence, swathing and threshing dates, seed shattering, seed yield and oil concentration, weed pressure and types, weed control level, and seasonal precipitation and temperature values. Treatments were considered a fixed effect in the analysis. Treatment means separation were performed by *F*-protected LSD comparisons at the $P = 0.05$ level of significance for each character evaluated.

Economic comparisons considered treatment input costs and seed yield production. Treatments with high input costs needed greater yield production to justify the cost of treatment. For these studies treatment input expenses were primarily associated with seed costs, herbicide costs, technology fees, seed coatings, and anti-shattering chemicals.

Results and Discussion (Dickinson only)

No useful data were collected from the study at Dickinson in either 1999 or 2000. Spring frosts and herbicide damage thinned plant stands of all fall-seeded treatments to unmanageable levels in 1999. The few remaining plants in fall-seeded plots were unable to compete with weeds for growth resources, even when herbicides were applied. Moreover, the low plant populations (< 1 plant/m^2) damaged yield and other data. A spring wind storm (gusts > 60 mph) sheared emerged seedlings and redeposited crop residue randomly across the study in 2000. Fall-seeded plots were destroyed and the experiment was abandoned.

Literature Cited

Berglund, D.R., and K.McKay. 1997. Canola Production. North Dakota Agric. Ext. Stn. Bull. A-686 (Revised)

Canola Council of Canada. Canola Production Centre 1997 Report. http://www.canola-council.org/ (1/1/99)

Degenhardht, D.F., and Z.P. Kondra. 1981a. The influence of seeding rate on seed yield and yield components of five genotypes of

Brassica napus. Can. J. Plant Sci. 61:175-183.

Degenhardht, D.F., and Z.P. Kondra. 1981b. The influence of seeding date and seeding rate on seed yield and growth characters of five genotypes of *Brassica napus*. Can. J. Plant Sci. 61: 185-190.

Deynze, A.E., P.B.E. McVetty, R. Scarth, and S.R. Rimmer. 1992. Effect of varying seeding rates on hybrid and conventional summer rape performance in Manitoba. Can. J. Plant Sci. 72:635-641.

Hanson, B.K., and J.R. Lukach. 1998. 1998 performance of row, oil and specialty crops in Northwestern North Dakota. Langdon Research Extension Center Performance Report No.73.

Kirkland, K.J., and E.N. Johnson. 1998. Summary of late fall and early spring seeding of herbicide tolerant c3nola. Report Agric. and Agri-Food Canada. Scott, SK.

Kondra, Z.P. 1975. Effect of row spacing and seeding rate on rapeseed. Can. J. Plant Sci. 55:339-341.

Kondra, Z.P. 1977. Effects of planted seed size and seeding rate on rapeseed. Can. J. Plant Sci. 57:277-280.

McVetty, P.B.E., R. Scarth, and S.R. Rimmer. 1988. Agronomic studies in hybrid spring canola rapeseed (Brassica napus L.) 7th International Rapeseed Congress. p. 253-258.

Oelke, E.A. And D.G. LeGare. 1988. Summary of Canola Research in Minnesota on Planting Rate and Date. Preliminary Report.

[Back to 2001 Annual Report Index] [Back to Agronomy Reports]

[DREC Home] [Contact DREC] [Top of Page]
