2017 Annual Report for the Agriculture Demonstration of Practices and Technologies (ADOPT) Program

Project Title: THE EFFECT OF SEEDING BETWEEN ROWS ON CANOLA ESTABLISHMENT, YIELD AND QUALITY PARAMETERS

Project Number: 20160380

Producer Group Sponsoring the Project: Western Applied Research Corporation

Project Location(s):

- Scott Saskatchewan, R.M. #380 Legal land description: NE 17-39-20 W3

Project start and end dates (month & year): May 2017 and completed January 2018

Project contact person & contact details:

Jessica Weber (General Manager) on behalf of Gazali Issah
Western Applied Research Corporation
P.O. Box 89, Scott, SK S0K 4A0
Phone: 306- 247-2001
Email: jessica.weber@warc.ca

Objectives and Rationale

Project objectives:

The objective of this experiment was to determine the impact of previous stubble rows on seed placement and emergence in canola (seeding on the previous row, in-between rows and random).

Project Rationale:

GPS guidance and automated steering have given producers the technology to improve farming practices. Following this technological advancement, there has been considerable interest regarding the potential benefits of inter-row seeding. The benefits associated with inter-row seeding are better seed placement that provides an increased seed contact with soil and better germination. These factors can lead to an enhanced yield. Inter-row seeding has improved plant density in canola up to 3-49% relative to across rows, in two locations in Alberta (Coles, 2011). Current GPS can narrow accuracy of field operations around the six to 10-inch range. However, to obtain yield benefits associated with inter-row seeding, more accurate technologies are required. Real-time kinematic (RTK) networks can provide guidance of farm machinery to within an inch or less. However, for producers to invest in this costly technology there should be an indication of the intended benefits of their investments.

Methodology and Results

Methodology:

This demonstration was conducted at the AAFC Scott Research Farm in 2017. A randomized complete block design arranged as a 2 x 3 factorial with four replicates was used. Three seeding directions (inter-row, on-the-row and random) relative to the previous crop were used at two canola seeding rates (3 lbs/ac and 5 lbs/ac). Canola (L140P) was directly seeded into wheat stubble using an R-tech plot drill with a seeding rate of 115 seeds m^{-2}. Fertilizer was applied according to soil test recommendations to target 40 bu/ac. Pesticides were applied as required.

Table 1. Treatment list representing seeding rate and direction

Trt #	Seeding Rate (lbs/ac)	Seeding Direction
1	3	Inter-row
2	5	Inter-row
3	3	On-the-row
4	5	On-the-row
5	3	Random
6	5	Random

Data Collection:

Plant densities were determined by counting numbers of emerged plants on 2 spots x 2 rows x 1m row lengths per plot approximately three weeks after emergence. Plant vigour was assessed using a visual rating scale that assigns a score from 1 to 5 according to the plant condition. Yield was determined from cleaned harvested grain samples and corrected to 10% moisture content. Oil content and green seed were calculated for each treatment. Weather data was recorded from the online database of Environment Canada weather station.

Growing Conditions:

The 2017 growing season started with great soil moisture in April and May with 30.9 mm and 69 mm of precipitation, respectively. Midseason growing conditions in June and July were very dry with 51% and 68% less precipitation compared to the long-term average. Throughout the growing season, the temperature was very similar to the long-term average. Growing degree days were higher than the long-term average for the months of April to July and lower for the remaining months (Table 2).

Table 2. Mean monthly temperature, precipitation and growing degree day accumulated from April to October in 2016 and 2017 at Scott, SK.

Year	April	May	June	July	August	Sept.	Oct.	Average /Total
Temperature (°C)								
2016	5.9	12.4	15.8	17.8	16.2	10.9	1.6	11.5
2017	3.0	11.5	15.1	18.3	16.6	11.5	3.8	11.4
Long-term[z]	3.8	10.8	14.8	17.3	16.3	11.2	3.4	11.1
Precipitation (mm)								
2016	1.9	64.8	20.8	88.1	98.2	22.2	33.1	329.1
2017	30.9	69.0	34.3	22.4	53.0	18.9	20.9	228.5
Long-term[z]	24.4	38.9	69.7	69.4	48.7	26.5	13.0	290.6
Growing Degree Days								
2016	58.9	224.9	303	398.7	343.8	176.2	12.5	1518.0
2017	16.6	202.7	283.3	399.1	348.4	194.8	33.8	1478.7
Long-term[z]	44	170.6	294.5	380.7	350.3	192.3	42.5	1474.9

[z]Long-term average (1985 - 2014)

Analysis:

The data was statistically analysed using the PROC MIXED in SAS 9.4. The residuals were tested for normality using the Shapiro-Wilk test, data were normally distributed, and therefore no transformation was required. Equal variance was tested using Levene's to meet the assumptions of ANOVA. Treatment means were separated using Tukey's Honestly Significant Difference (HSD) with a level of significance at 0.05. Replications were treated as random effect factor while treatments were fixed-effect factors.

Results

Plant density

Plant density was assessed to determine the effects of seeding rates and seeding direction. Three measurements were done at one week after seeding, two weeks and three weeks. No plants had emerged one week after seeding. Due to external factors plant stand was severely affected. A pest problem was detected and all the plots needed to be treated with insecticide. This situation caused huge variation among treatments. Data was not analysed statistically as plant stand was reduced and

the effects of the treatments could not be detected. Plant density in all but one of the treatments went down from the second to the third measurement (Figure 1).

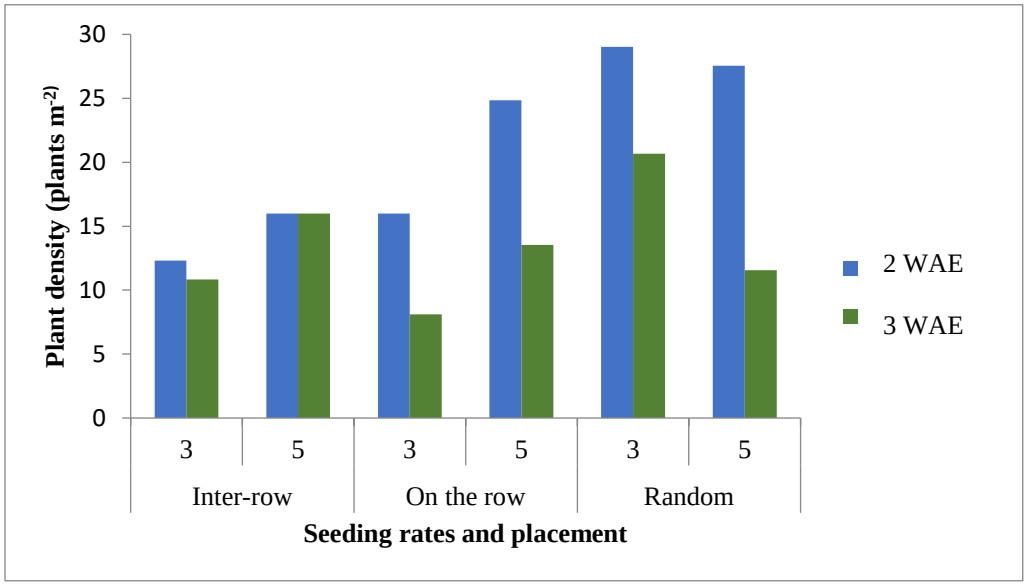

Figure 1. Canola plant density at two and three weeks after seeding with two seeding rates and three seeding placement.at Scott, SK in 2017.

Vigour rating

No differences were detected for vigour between the seeding rates (P= 0.0706), seeding placement (P= 0.3708), and no interactions existed between these factors (P=0.8607). A trend was observed that indicated a higher vigour for plants seeded at 5 lb/ac. These results could be attributed two factors: (1) that the highest seeding rate resulted in a denser canopy that reduced crop-weed competition (2) that the insect activity was less influential on overall plant density because of the higher seeding rate. Inter-row and on-the-row seeding had a trend toward a higher vigour when seeding at 5 lb/ac.

Grain yield

No differences were detected for seeding rate (P= 0.2597), seeding placement (P= 0.3363) or interaction between these factors (P= 0.1075). Interestingly, when plants were seeded randomly there was a higher yield trend. Also, for this treatment, the lower seeding rates had a slightly higher yield.

Canola is highly plastic and can adjust yield within a wide range of plant population. The

mechanisms to compensate for the low plant density are an increased number of branches, number of pods per plant and more seeds per pod. Angadi et al. (2013) results showed that under a wide range of plant densities canola yield was adjusted and yield was similar for 40 and 80 plants m^{-2}. Due to this plasticity, we hypothesize that yield did not have difference among treatments and the plants were able to compensate for the reduced plant stand caused by the pest problem.

Oil content & Green seed

Oil content was very similar for all the treatments and no differences were observed for seeding rate (P= 0.2850), seeding placement (P= 0.7117) or interaction between these factors (P= 0.7506). Oil contents values were so similar that a trend was not observed among treatments. Green seed percentage analyses were not performed because all values were well below the maximum level of green seed (2%) required for No.1 grade canola.

Conclusions and Recommendations:

The results from this project are circumspect due to low plant stand caused by high insect activity. Plots had to be sprayed with insecticide but plant density was severely affected. No effects for yield at two seeding rates or seeding direction were detected. The oil content results, like yield, when seeded at a higher rate had a tendency for higher oil content.

The other variable assessed was vigour and as with the other evaluated parameters, no differences were observed, although the higher seeding rate tends to have a better vigour rating. We hypothesized that due to the low plant stand, the effects of the different seeding rates and direction were masked and that is the reason for a lack of response to the treatments. Additionally, the plastic attributes of canola likely compensated for the low plant stand, minimizing the negative impact on yield. Furthermore, our results determined that seeding direction played a very little role in overall yield production, as well as any seed quality parameters. Without the reduced plant stand, the results could have been more determinant and differences among treatment could be observed.

Supporting Information

Acknowledgements

We would like to thank the Ministry of Agriculture for the funding support on this project. We would like to acknowledge Herb Schell and our summer staff for their technical assistance with project development and implementation for the 2017 growing season. This report will be distributed through WARC's website and included in WARC's and Agri-ARM annual reports.

Appendices

Appendix A

Abstract

GPS guidance and automated steering have given producers the technology to improve farming practices. Following this technological advancement, there was an increased interest in the potential benefits of inter-row seeding. This demonstration was conducted as the AAFC Scott Research Farm in 2017. A randomized complete block design arranged as a 2 x 3 factorial with four replicates was used. Three seeding directions (inter-row, on-the-row and random) relative to the previous crop were used at two canola seeding rates (3 lbs /ac and 5 lbs /ac). Canola (L140P) was directly seeded into wheat stubble using an R-tech plot drill with a seeding rate of 115 seeds m^{-2}. Plant density was severely affected caused by an insect problem and plants had to be treated but plant stand was already reduced. No effects for yield at two seeding rates or seeding direction were detected. The oil content results, like yield, when seeded at a higher rate had a tendency for higher oil content. We hypothesized that due to the low plant stand, the effects of the different seeding rates and direction were masked and that this is the reason for a lack of response to the treatments. Additionally, the plastic attributes of canola likely compensated for the low plant stand, minimizing the negative impact on yield. Furthermore, our results determined that seeding direction played a very little role in overall yield production, as well as any seed quality parameters. Without the reduced plant stand, the results could have been more determinant and differences among treatment could be observed.

Extension Activities

The results will also be shared at the annual Crop Opportunity event hosted in March with approximately 150 people in attendance. A fact sheet will be generated and distributed on the WARC website, as well as all Agri-ARM and WARC events to ensure the information will be transferred to producers.

Apendix A
Agronomic information for 2017 demonstration

Table A.1. Selected agronomic information for the '*Effect of seeding between rows on canola establishment, yield and quality parameters*' trial at Scott, SK.

Seeding Information	**2017**
Seeder	R-Tech Drill, 10-inch row spacing, knife openers
Seeding Date	May 10, 2017
Cultivar and Seeding Rates	Canola (L140P) at 115 seeds/m2
Stubble Type	Wheat
Fertilizer applied	Urea + AS blend: 34-0-0-11 @ 234 lbs/ac mid-row MAP: 11-52-0 @ 31 lbs/ac
Plot Maintenance Information	
Pre-plant herbicide	Glyphosate @ 1L/ac and Bromoxynil @ 0.4L/ac (May 16, 2016)
In-crop herbicide	Liberty @ 0.81L/ ac on June 7, 2017 and 2nd in-crop: Liberty @ 0.61 L/ac on June 21, 2017 3rd in-crop: Liberty @ 1.35 L/ac on June 28, 2017
Fungicide	Priaxor @ 180 mL/ac (July 04, 2017)
Insecticide	Decis @ 6 ml/ac on May 29th
Desiccation	Reglone-Ion @ 0.89L/ac on August 28, 2017

Harvest Date	September 7, 2017

References

Angadi S.V., Cutforth H.W., McConkey B.G., Gan Y. 2003. Yield adjustments by canola grown at different plant populations under semiarid conditions. Crop Sci. 43: 1358-1366

Coles K. 2011. Precision tools for on farm research: Inter-row seeding. Southern Applied Research Association. Agronomy update. Lethbridge, AB