2016 Annual Report for the Agriculture Demonstration of Practices and Technologies (ADOPT) Program

Project Title: Evaluating Canola Desiccation Options

Project Number: 20150385

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 2016 and completed January 2016

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Objectives and Rationale

Project objectives:

The objective of this project was to demonstrate the use of desiccants for straight cut canola and the effects of desiccates on stem dry down.

Project Rationale:

While good agronomic practices can aid in maximizing canola yields, proper harvest management is key to realizing those yields. Seed and quality losses caused by improper harvesting timing, techniques, and handling or the combination of these practices, can all result in reduced crop grain yield and seed quality.

Swathing has many positive attributes, as it allows for earlier harvest (eight to 10 days), provides an even seed maturity (particularly in fields of uneven maturity), earlier harvest to avoid fall frost and accelerate dry down, and reduce shatter losses. However, it is difficult to swath the entire canola crop at the optimal timing, it also requires more labour, time, and fuel.

Straight-cut combining allows for faster combing due to quick dry down of crop and weeds, provides perennial weed control of Canada thistle, perennial sow thistle, and quack grass. Straight- cut combining also reduces labour and equipment costs and ultimately results in larger seeds with a higher oil content and reduced green seed compared to swathing. As there are several harvest aid options for canola, it is important to determine which product provides the best and fastest stem dry down, and if each desiccant will affect seed quality.

Methodology and Results

Methodology:

The demonstration was arranged as a randomized complete block design (RCBD) with four replicates at Scott, SK 2016. The demonstration consisted of six treatments including untreated check (straight cut), Heat LQ + Merge, Glyphosate, Heat LQ+ Glyphosate + Merge, Reglone, and swathed (Table 1). Desiccation treatments were applied using 10 gal/ ac water volume. Treatment application timings varied based on seed colour change assessment with Heat LQ applications at 60-75% SCC, Glyphosate at 40- 50% SCC, Reglone at 80-90% SCC and the swathed treatments at 60%- 75% SCC. Prior to seeding, soil samples were collected at three depth increments (0-15 cm, 15-30 cm and 30-60 cm) in order to determine fertilizer rates recommendations (Table A1). The trial was sown on wheat stubble using an R-tech drill with 10-inch row spacing and were seeded double wide. The canola

variety was Liberty Link 130 and was seeded at 150 seeds/m^2. All N (urea; 46-0-0) and S (ammonium sulphate; 21-0-0-24) was side-banded while P (monoammonium phosphate) was seed-placed. Weeds and disease were controlled using registered herbicide and foliar fungicide applications.

Table 1. Canola desiccation products and application rate

Trt #	Trade Name	Common Name	Group	Application Rate
1	Untreated Check	-	-	-
2	Heat LQ + Merge	Saflufenacil	14	50 g ai/ ha 1L/ ha
3	Glyphosate	Glyphosate	9	900 g ae/ ha
4	Heat LQ + Glyphosate + Merge	Saflufenacil Glyphosate	14 9	36 g ai/ ha 900 g ai/ ha 0.5 L/ ha
5	Reglone	Diquat	22	1.7 L/ha
6	Swathed	-	-	-

Data Collection:

Plant densities were determined by counting numbers of emerged plants on 2 x 1 meter row lengths per plot approximately a week after the first rows became visible. Days to maturity (DTM) were determined based on 60% seed colour change. A stem dry down visual rating scale was used to determine effect of desiccant on stem moisture. Seed moisture samples were collected from five plants per plot at 5, 7, 9, 11, 13 days after application (DAA). Seed moisture was determined by shelling the five plants, collecting the fresh seed weight, drying and weighing the seeds. Seed moisture percentage was calculated from fresh minus dry weight divided by fresh weight multiplied by 100. Seed shatter was collected prior to and after harvest and will be reported as a percent total per plot. Seed shatter was collected for the untreated and desiccated treatments, however, due to the physical constraints of collecting seed shatter for the swathed treatment, an accurate seed shatter was not collected. Seed quality data such as thousand kernel weights, test weight, oil content, % green seed and grain moisture were also collected. Harvest was delayed longer than initially planned due to the excessive moisture received during August. Yields were determined from cleaned harvested grain samples and corrected to 10% moisture content. Weather data was recorded from the online database of Environment Canada weather station.

Growing Conditions:

The 2016 growing season started out very dry in April with only 1.9 mm of precipitation. May, July, and August were far above the long-term average, with 40 %, 21 %, and 50 % increase, respectively. Overall, when looking at the accumulated amount of precipitation in 2016 from April to October, there was 38.5 mm more than the long-term total. 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 – July, and lower for the remaining months (Table 2).

Table 2. Mean monthly temperature, precipitation and growing degree day accumulated from April to October 2016 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
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
Long-term[z]	24.4	38.9	69.7	69.4	48.7	26.5	13	290.6
Growing Degree Days								
2016	58.9	224.9	303	398.7	343.8	176.2	12.5	1518.0
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 and equal variance to meet the assumptions of ANOVA. The means were separated using a Tukey's Honestly Significant Difference (HSD) test with level of significance at 0.05. Replications were treated as random effect factor whiles treatments were fixed effect factors.

Results & Discussion:

Stem dry down assessments were made 5,7,9,11, and 13 DAA to assess the efficacy of individual desiccant products. Stem dry down following the glyphosate application occurred slowly with visual difference only appearing 9DAA (Figure 1). Stem dry down of glyphosate compared to the untreated was relatively similar after initial application but appeared to have greater dry down 13 DAA compared to the untreated. Applications of Heat LQ and Heat LQ + Glyphosate were relatively similar with rapid stem dry down, however, Heat LQ + Glyphosate appeared to have slightly greater stem dry down 11 DAA. Reglone had the fastest stem dry down compared to the remaining treatments (Figure 1). However, in terms of "combinability" the Heat LQ, Heat LQ + Glyphosate and Reglone treatments were nearly identical. In contrast, the canola stems in the glyphosate treatments had a slightly higher stem moisture which made combining more difficult and slowed harvest.

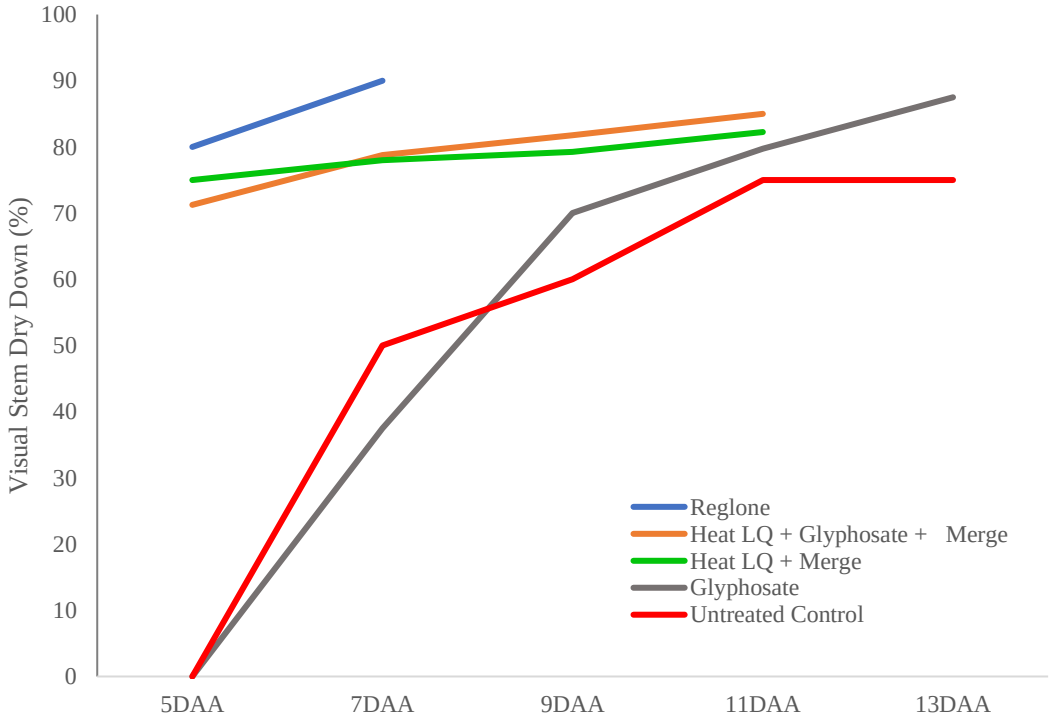

Figure 1. The effect of dry down method (desiccated vs. swathed) on canola stem dry down at Scott, 2016.

Seed moisture content was also collected at 5, 7, 9, 11, and 13 DAA to determine the effect of desiccant on overall seed dry down. A similar trend to stem dry down was noted for seed moisture in which the glyphosate applications did not have a significant effect until 9DAA, with a slow but constant decline in seed moisture afterwards (Figure 2). Heat LQ and Heat LQ + Glyphosate had a

very similar trend in which seed moisture declined steadily until 9 DAA followed by a slow decline until 11 DAA. Although both treatments were effective in reducing seed moisture, treatments containing Heat LQ + Glyphosate appeared to be more effective in seed dry down compared to Heat LQ alone, as seed moisture content 5 DDA was approximately 25% vs. 17%, respectively (Figure 2). Reglone decreased overall seed moisture by 2% in two days, however, as the seeds were 90% SCC, moisture content was initially lowered compared to the other desiccant applications.

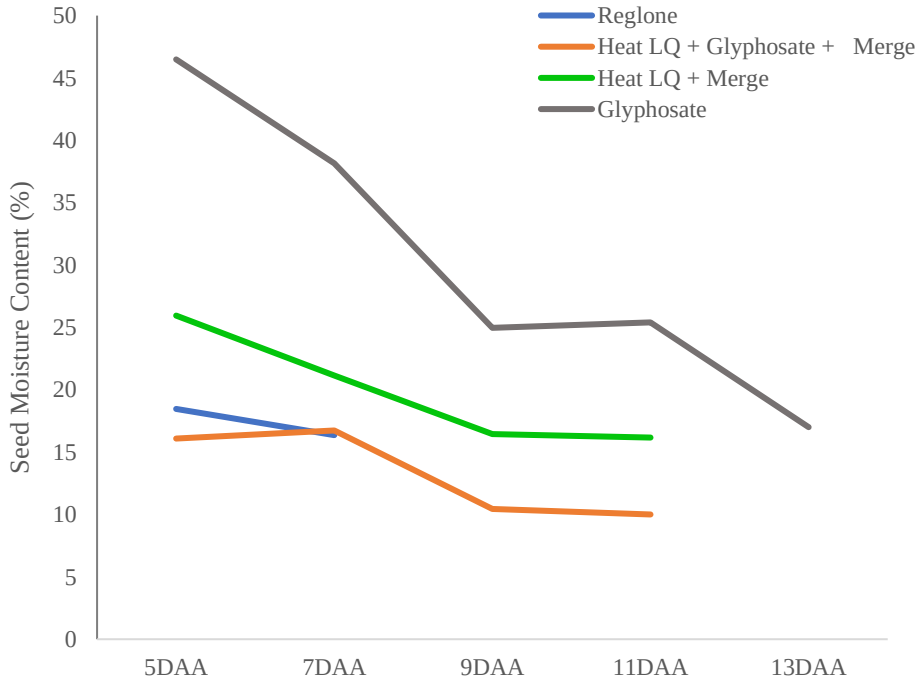

Figure 2. The effect of dry down method (desiccated vs. swathed) on canola seed moisture content at Scott, 2016.

The effect of desiccants vs. swathed treatments did not significantly result in different yield potentials, nor did a variation of products result in overall yield differences (Table 2). Overall, there was a 2 bu/ ac difference between treatments, indicating that the method in which dry down occurs will not influence the overall seed production.

Table 3. The P values were generated using a One-way Analysis of Variance (P< 0.05) to determine the effect of desiccant on yield (bu/ ac), thousand kernel weight (TKW) (g/1000s), test weight (kg/hL), oil content (%), green seed (%), and seed shatter (%) at Scott, 2016.

	Yield	TKW	Test Weight	Oil Content	Green Seed	Seed Shatter
	bu ac^{-1}	g/ 1000s	kg/hL	%	%	%
Desiccant	0.595	0.005	0.000	0.337	0.006	0.102

There was a significant effect of desiccant on thousand kernel weight (TKW) and test weight (P= 0.005; 0.000) (Table 3). The untreated check resulted in the lowest test weight compared to all desiccated and swathed treatments, with swathed resulting in the highest test weight with a slight, non-significant decline of 0.5% with glyphosate (Figure 3). A significant decline in test weight was detected for treatments of Heat LQ, Heat LQ + Glyphosate, and Reglone compared to the swathed treatments, however, the overall difference between desiccated treatments was less than 2% (Figure 3). In contrast, TKW varied significantly between treatments in which the swathed and glyphosate treatments resulted in a 4% and 5% decline compared to the Heat LQ, Heat LQ + Glyphosate, and Reglone treatments. These results indicate that although glyphosate did not influence seed test weight, the overall seed mass was negatively influenced by glyphosate applications.

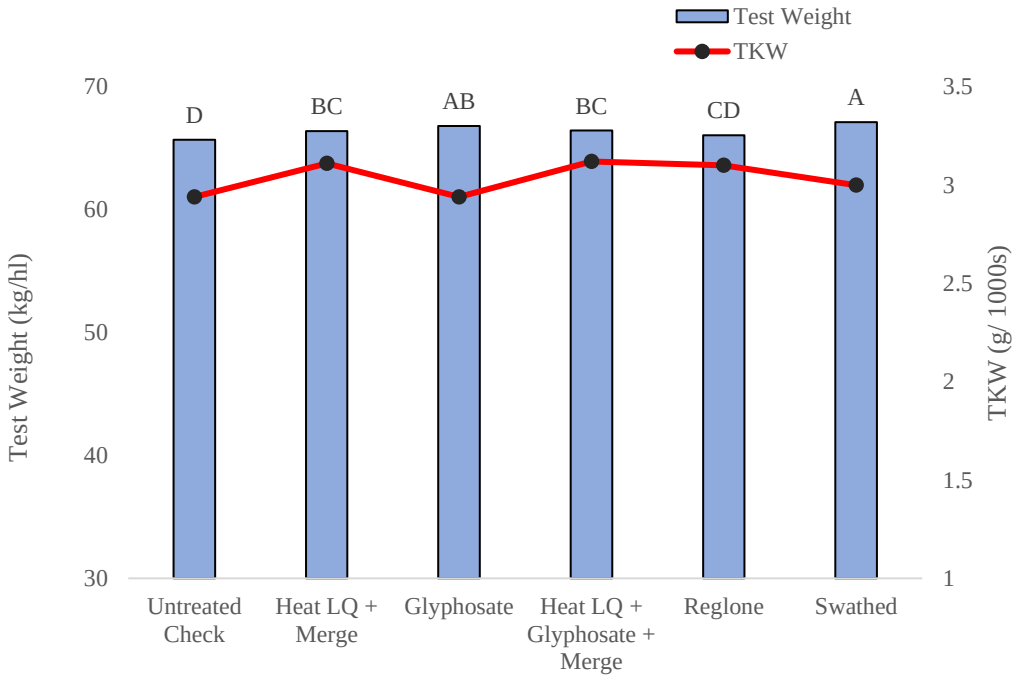

Figure 3. The effect of dry down method (desiccated vs. swathed) on canola test weight and thousand kernel weights (g/1000s) at Scott, 2016.

Seed shatter was the greatest for the untreated control treatment, with an 8% loss of seed compared to the lowest shattering treatment, glyphosate, with a 2% shatter loss. Reglone resulted in the second highest shatter rate with a 6% shatter loss, while Heat LQ and Heat LQ + Glyphosate treatment resulted in a 4% and 5% shatter loss, respectively (Figure 4). Seed loss was greater than anticipated, however, this could be attributed to delayed harvest due to continuous rainfall during August (Table 2). Variety is another factor to consider when discussing seed loss, as a pod-sealant variety was not used in this trial and therefore losses would likely be lower if a pod-sealant variety was used.

Green seed was relatively similar among all treatments, expect for glyphosate, which resulted in the greatest green seed of approximately 1.25% (Figure 4). Although glyphosate resulted in the highest green seed it was below the maximum threshold for a No.1 seed grade. The desiccant treatments were expected to have a lower green seed percentage compared to the swathed treatments (Canola Council of Canada, 2017). However, our results do not indicate that straight-cut vs. swathed had any significant differences except for the glyphosate treatment. Similar results were also observed by Holzapfel (2015) in which it was reported that harvest method had an inconsistent effect on green seed percentage.

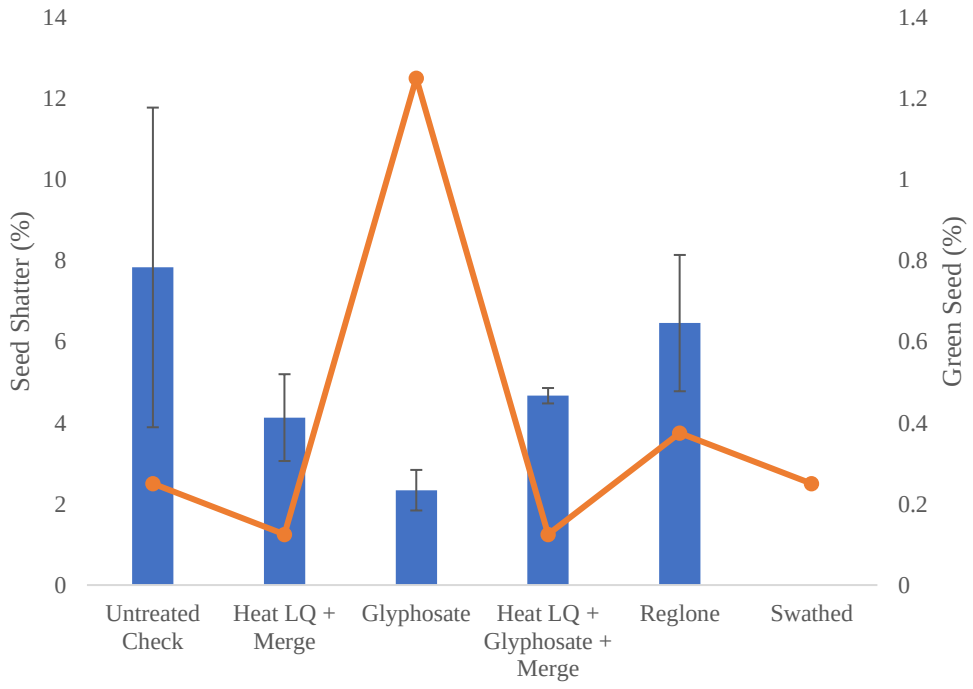

Figure 4. The effect of dry down method (desiccated vs. swathed) on canola seed shatter percent and green seed percent at Scott, 2016.

Swath Vs. Straight Cut Combining

Our findings are consistent with previous research (Watson, et al. 2008; Derwent et al. 2000; Holzapfel 2015) in which straight- cutting canola via desiccants can be a useful tool for canola harvest management. Product selection is an important factor to consider when straight-cut combining. The results indicate that Heat LQ, Heat LQ + Glyphosate and Reglone are suitable products when desiccating, as stem dry down and harvestability where very similar among these products. Reglone had a higher seed shatter compared to the Heat LQ and Heat LW + Reglone, however, environmental conditions where a large factor as continuous rainfall delayed harvest and thus increased seed shatter. In terms of weed management, Heat LQ and Heat LQ + Glyphosate may provide better fall weed control compared to Reglone, due to the contact nature of Reglone. Glyphosate as a harvest aid was not effective due to poor stem dry down and overall reduced harvestability. These results coincide with Darwent et al. 2000 in which seed and/or foliage moisture dry down were not enhanced by glyphosate applications. As there are available options for true desiccations, glyphosate applied alone may be better utilized for weed control rather than as a harvest aid.

Product selection is an important factor to consider when determining harvest management, however, there are several other factors to consider when planning your harvest. Holzapfel (2015) indicated that early, uniform seeding is a critical component for successful straight-cut combining, as consistent maturity will allow for proper application timing and therefore influence overall seed quality. Varietal selection is key for straight cut- combining as pod-sealant varieties will limit seed shatter losses. Therefore, harvest management should be considered during seed selection. In order to hedge harvest risk, producers may need to consider implementing varieties for both straight-cut and swathed harvesting. This may help producers effectively target the proper desiccation and swathing timing by expanding the target window.

Conclusions and Recommendations:

The results of this trial have provided insights to improve canola harvest management by demonstrating the effect of desiccants on canola harvestability. Straight-cut and swathed treatments had a negligible effect on both yield and oil content. Harvest methods did influence TKW, test weight, seed shatter and percent green seed. Swathed and glyphosate treatments had the highest test weight, however, seed mass (TKW) was the lowest for these two treatments compared to Heat LQ, Heat LQ + Glyphosate and Reglone. Reglone had the greatest seed shatter amongst desiccant products, however, due to environmental conditions the optimal harvest time was delayed. Overall harvestability was greatest for treatments of Heat LQ, Heat LQ + Glyphosate and Reglone. Glyphosate as a harvest aid was not effective due to poor stem dry down and overall reduced harvestability. As there are available options for true desiccations, glyphosate may be better utilized for weed control rather than as a harvest aid. To manage risk, producers may need to consider implementing varieties for both straight-cut and swathed harvesting. This may help producers effectively target the proper desiccation and swathing timing by expanding the target window.

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 2016 growing season. This report will be distributed through WARC's website and included in WARC's and Agri-ARM annual reports.

Appendices

Appendix A

Table A1. Soil test nutrient level results (lb/ ac) from Scott, SK 2016.

	NO_3-N	P	K	SO_4 -S	Cu	Mn	Zn	B	Fe	Cl
0 - 15	11	55	547	9	1.4	43.4	3.4	1.1	211	3
15 - 30	8			5						3
30 - 60	16			13						7

Abstract

Good agronomic practices can maximize canola yields and returns, however, proper harvest management is essential to achieving those yields. Swathing and straight-cut combining both have advantages and disadvantages, but determining which practice best suits your operation can be a difficult decision, particularly when there are multiple harvest aid products available. This trial was developed to demonstrated the use of desiccants for straight cut canola and the effects of desiccates on stem dry down. The demonstration was arranged as a randomized complete block design with four replicates. The demonstration consisted of six treatments including untreated check (straight cut), Heat LQ + Merge, Glyphosate, Heat LQ+ Glyphosate + Merge, Reglone, and swathed. The results showed that straight-cut and swathed treatments did not influence overall yield nor oil content. Harvest methods did affect seed quality, percent seed shatter and percent green seed. Swathed and glyphosate treatments had the highest test weight, however, seed weight was the lowest for these two treatments compared to Heat LQ, Heat LQ + Glyphosate and Reglone. Reglone had the greatest seed shatter amongst desiccants. Overall harvestability was greatest for treatments of Heat LQ, Heat LQ + Glyphosate and Reglone. Glyphosate as a harvest aid was not effective due to poor stem dry down and overall reduced harvestability. Utilizing both straight-cut and swathed harvest management strategies may help producers hedge harvest risk by expanding the application window.

Extension Activities

This project was shown to producers and agronomists at the Scott Field Day in July 2016, with an attendance of approximately 175 people. Signs stating the objective of this demonstration with acknowledgement of the ADOPT program and the Saskatchewan Ministry of Agriculture were posted in front of the plots. 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.

Finances

Expenditure Statement

Majority of expenses associated with this project went towards labor ($6,000) required for the establishment of this field trial, including field operations, data collection, extension, data analyses and reporting. An amount of $1000 was requested for materials and supplies to cover costs of research supplies, fuel, crop inputs etc. There was a request for $300 each was requested for administration costs (see attached expenditure statement for details).

Expenditure information for *Evaluating Canola Desiccation Options* at Scott, SK in 2016 (ADOPT 20150385).

	Year 1 ($)	Year 2 ($)	Year 3 ($)	Total ($)
Salaries & Benefits				
Students	3,400			3,400
Postdoctoral / Research Associates				
Technical / Professional Assistants	5,500			5,500
Consultant Fees / Contractual Services				
Rental Costs				
Materials & Supplies	500			500
Project Travel				
Field Work				
Collaborations / consultations				
Other				
Field Day	300			300
Administration	300			300
Miscellaneous				
Total	**10,000**			**10,000**

References

Canola Council of Canada. 2017. Harvest management. [Accessed March, 2017] http://www.canolacouncil.org/canola-encyclopedia/managing-harvest/harvest-management/#swathing-vs-direct-combining-canola

Darwent, A.L., Kirkland, K.J., Townley-Smith, L., Harker, K.N. and Cessna, A.J., 2000. Effect of preharvest applications of glyphosate on the drying, yield and quality of canola. Canadian Journal of Plant Science. 80(2): 433-439.

Holzapfel C. 2015. What's new in straight-combining canola? [Accessed March, 2017] http://iharf.ca/wp-content/uploads/2015/01/Whats-New-with-Straight-Combining-Canola-Chris-Holzapfel.pdf

Watson, P, Brandt, S., Clayton, G., Harker, N. 2008. Canola harvest management study. CARP, Canola Council of Canada.