

Agriculture Demonstration of Practices and Technologies (ADOPT)

Project Final Report

The final project report should be made available electronically (MS Word). Additional data tables and or graphs may be submitted in spreadsheet format. Due to formatting, printing and distribution requirements, final reports will not be accepted as PDF documents. Completed reports must be returned by email to Evaluation.Coordinator@gov.sk.ca.

Project Title: Do micronutrients applied to canola actually increase yield?

Project Number: ADOPT 20241011

Producer Group Sponsoring the Project: Saskatchewan Oilseed Development Commission

Project Location(s): *Provide the name or number of the rural municipality, nearest town or legal land location if possible. Provide the name of any cooperating landowner(s).* Swift Current (WCA RM #137), Redvers (SERF RM #61), Indian Head (IHARF RM #156), Scott (WARC RM #380), and Melfort (NARF RM #428)

Project start date (month & year): 4/1/2025

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Abstract *(maximum 200 words)*

Detail key elements from the project objectives, methodology, results and conclusions to provide a short concise summary of the project. List extension activities such as field days or workshops and include the number of people who visited the project.

A small-plot randomized trial with four replicates was conducted at five locations in SK to evaluate the response of canola to the micronutrients Copper (Cu), Boron (B), and Zinc (Zn). Micronutrients were either applied in-furrow at seeding time or foliar at bolting. The locations were Melfort (NARF), Redvers (SERF), Scott (WARC), Indian Head (IHARF), and Swift Current (WCA). Data collection consisted of environmental conditions, soil sampling, stand establishment, tissue testing, maturity, seed yield, and oil. The spring of 2025 was drier and warmer (May), while conditions cooled off in the summer (June-July), and warmed up near maturity (August). Micronutrient applications never significantly affected plant stands, maturity, yield or oil at any location. Despite some locations having low soil B, tissue tests for all treatments at all sites were sufficient. No sites demonstrated low soil Cu; however, sites with moderate Cu, still had tissue tests with Cu deficiency. Sites with soil Zn deficiencies often had low tissue test Zn, except for one location. Applying micronutrients often increased their concentration in tissue test results; however, this never translated into a

yield response. Overall, canola showed very little response to B, Cu, and Zn across several locations in SK, despite low soil test results.

Extension: WCA Annual Field Tour July 17, 2025 85 people, NARF & AAFC Joint Annual Field Day July 23rd, 2025 126 people, NARF & AAFC Minor/Niche Crops Tour July 24th, 2025 36 people, 17th Annual NE Ag Update February 3, 2026 ~80 people. WARC Annual Field Day, July 9, 2025 ~150 people, SERF Annual Field Day July 10, 2025 to 80 attendees, Indian Head Crop Management Field Day July 15, 2025 to 157 people. Results will also be shared at the upcoming Agvise Laboratories 36th Annual Soil Fertility Seminar in Portage La Prairie, MB on March 3, 2026 and Saskatoon, SK on March 5, 2026 by Chris Holzapfel in a presentation titled, "Applied Fertility Research Highlights: N, P, and Beyond."

Project Objectives

Provide a short statement outlining the project objectives. Identify the key concept this project was designed to demonstrate. For example, you might use a statement such as *"This project was intended to demonstrate and compare the benefits of....."* or *"The objective of this project was to demonstrate the impact of..."*

To demonstrate the yield and quality response of canola to in-furrow and foliar applications of different micronutrients in multiple soil zones in Saskatchewan. To demonstrate to producers the importance of soil testing and tissue testing as tools for evaluating the potential need for micronutrient products in canola.

Project Rationale

Briefly describe why this project is of interest to local producers. Why is it important to have this project? What are the potential beneficial outcomes? What is the perceived need?

Micronutrients are important in the lifecycle of many plants; however, because they are required in much smaller quantities than macronutrients, their impact on plant performance is often harder to quantify (Canola Council, 2024). Boron (B), Copper (Cu) and Zinc (Zn) are commonly known micronutrients of canola on the western prairies (Canola Council, 2024). These three micronutrients may be deficient in sandy soils, high organic matter soils, and soils with high pH, which are characteristic of many growing regions in Saskatchewan.

The role of B in plant nutrition is not well understood, but it is thought to play an important role in plant metabolism and pollen production, which is why the micronutrient is so important during crop flowering (Canola Council, 2024). Of all the micronutrients in canola, B applications have been the most researched on the prairies over the last 25 years. Mahli et al. (2002) found that canola was responsive to B fertilization in growth chamber experiments, but rarely under field conditions where soil B was expected to be limiting, such as sandy soils. The experiment took place from 1997-2000 at seven locations in northeastern SK. Borate granular (14.3% B) was used for broadcast incorporation and seed-row placement of B, while Solubor (20.5% B) was used for foliar applications at 10-20% flower. There were a few sites where seed yield was increased with B fertilizer, and in most cases broadcast and incorporated B was better than seed row and foliar applications. When averaged over all seven site years, there was no significant yield increase with B fertilization. In the growth chamber experiments, seed and straw yield of canola increased by up to 13% with B fertilization. It is important to note that this experiment took place over 25 years ago and canola yields at the time were only 0.45-1.8 t/ha (8-32bu/ac), with most years and sites having around 20 bu/ac averages. More recent work was completed on B fertility in canola in western and eastern Canada in the 2010's. Ma et al. (2015) found that soil applied B had no significant effect on canola yield, but foliar applications at early flowering increased yield by up to 10%. In the project, soil applied B was a product from Alpine, containing 10% Boric Acid. Soil applied rates of B were 2kg/ha and the foliar applied rate was 500g B/ha applied in 200L/ha solution with 0.125%v/v Agral 90. The results of this study suggest that canola was able to utilize B more efficiently through the leaves of the plant than the roots. Boron applied to the soil may have also become bound to organic matter in the soil making it less bio-available or leached down the soil profile making it less accessible to the canola plants. Lastly, during periods of drought, B uptake can be limited as it requires mass flow or the presence of soil water for uptake (Canola Council, 2024).

Copper is an important micronutrient in enzyme reactions in plants, and low levels can result in reduced pollen formation and overall low carbohydrate levels in the plant (Canola Council, 2024). Canola's response to Cu has generally been found to be low, unless the soil has been deemed low (<0.2ppm, Canola Council). Karamonas et al. (1989) found that canola was responsive to additions of Cu at 5mg/kg in greenhouse experiments when manganese (Mn) was present in the soil. This was due to the antagonism of Mn and Cu (Karamonas et al. 1989). When Cu was applied alone there was no canola yield response. Many research studies have been conducted on the efficacy of Cu fertilization in cereal crops, but not canola. Mahli et al. (2004) found that wheat was very responsive to Cu fertilization on deficient soils. Mahli et al. (2004) also found that foliar apps of Cu were better for immediate correction of deficiency, as lower rates were still able to correct deficiencies when applied in this manner.

Zinc is a key factor in many enzymatic reactions in plants and is thought to be considered low in soils below 0.5ppm (Canola Council, 2024). Very little research has been conducted on Zn deficiencies in canola in Canada, but some research has been conducted in other parts of the world. Manaf et al. (2019) found the canola yielded significantly higher when fertilized with Zn at 5 and 10kg/ha. Soil levels of Zn in the study ranged from 0.37-0.48ppm in the top 6 inches, which would be considered low. Zn may become limiting in the soil when pH is high, as it may adsorb to lime, and when high rates of phosphorus (P) have been applied, as high P can inhibit Zn translocation (Canola Council, 2024). Canola is a high user of phosphorus, which could increase risk of Zn deficiency.

In recent years, many new high yielding canola varieties have been introduced, far exceeding the yield potential and fertility requirements of varieties from 25 years ago. With much higher yield potential, it can be speculated that higher levels of nutrients are needed to reach maximum yield potential. Additionally, many new fertilizer products have become available to Saskatchewan producers that make yield claims by providing micronutrients through in-furrow or foliar applications. Private companies are making yield claims based on internally funded trials, where published research has often found no response of these micronutrients in canola. On the other hand, publicly funded research on some of these micronutrients is lacking in general, and particularly with new high yielding varieties. Additionally, dry and hot summers may cause deficiencies of some of these nutrients that would not have occurred during wet or normal conditions when some of the micronutrient trials took place on the prairies.

The intended benefit of this demonstration was to showcase to producers' different micronutrients they may be applying to their crops based on assumptions of yield and/or quality improvements. By collecting micronutrient levels in the soil prior to seeding, tissue testing after foliar applications, and collecting yield and quality data we were able to discuss with producers at field days and winter meetings whether micronutrient products are worth the money and resources based on results from several different locations in Saskatchewan. This project was also identified as a high priority by Canola growers on the Board of Directors for SaskOilseeds.

Methodology

Fully describe how the project was set up and run. You should provide enough information so that any reader can understand what you did, and where and when you did it. From that they can determine if your report has any relevance to their own operation. For example, your description should include all relevant items such as 1) the number and size of any field plots, 2) what was seeded, 3) what treatments were applied to the plots, 4) the schedule or timing of any relevant activities such as seeding, treatment application or harvest, and 5) what was measured to evaluate the success of any treatment. If your project dealt with animals, you should be sure to include 1) the number of animals in each trial group, 2) the treatment or procedure applied to each group, and 3) what was measured to evaluate the success of each treatment.

The demonstration was small-plot, completely randomized, with four replications at all sites. The sites included Melfort (NARF), Scott (WARC), Indian Head (IHARF), Redvers (SERF), and Swift Current (WCA). Melfort is in the northern black soil zone, Indian Head and Redvers are in the southern black soil zone, Scott is in the northern dark brown soil zone, and Swift Current is in the southern brown soil zone.

There were seven treatments in the demonstration that consisted of applications of the micronutrients boron (B), copper (Cu), and zinc (Zn) in canola (Table 1). The micronutrients were either applied in-furrow at seeding time or as foliar applications at bolting/early flower. In-furrow applications were made at: 1 kg of B/ha, 2kg of Cu/ha and 5 kg of Zn/ha. B was applied as Granubor at 7kg/ha (15% B), Cu was applied as Copper Sulphate at 8 kg/ha (25.2% Cu), and Zn was applied as Zinc Sulphate at 14 kg/ha (35.5% Zn). All foliar applications were made at 1L/ac as Alpine Microbolt® B, Cu and Zn products. Most proposed sites had at least one micronutrient that was listed as low on soil test reports (Zn at Indian Head and Redvers, B at Melfort and Scott, Zn and B at Swift Current).

Table 1. Treatments applied in “Do micronutrients applied to canola actually increase yield?” at Swift Current, Scott, Melfort, Redvers, and Indian Head, SK in 2025.

	TRT Name	Rate	Timing
1	Control	--	--
2	In-furrow Boron	1kg B/ha	Seeding
3	Foliar Boron	1L/ac (95g/ac)	Bolting/Early flower
4	In-furrow Copper	2kg Cu/ha	Seeding
5	Foliar Copper	1L/ac (134g/ac)	Bolting/Early flower
6	In-furrow Zinc	5kg Zn/ha	Seeding
7	Foliar Zinc	1L/ac (117g/ac)	Bolting/Early flower

Seeding equipment and crop management varied by location (Table 2). Weeds, insects, and disease were controlled using registered products with the specific products at each participating site varying at the discretion of the site managers. All fertility, aside from B, Cu, and Zn were applied as per soil recommendations for each site to be non-yield limiting. Desiccants were used when necessary, and all plots were harvested using plots combines. Agronomic details and dates of operations at each location are provided in

Table 7 below.

Table 1. Agronomic information and dates of operation for Do micronutrients applied to canola actually increase yield? at Swift Current, Scott, Melfort, Redvers, and Indian Head, SK in 2025.

Factor/Field Operation	Swift Current	Scott	Melfort	Redvers	Indian Head
Pre-emergent Herbicide	RoundUp Transorb 1L/ac & AIM 47mL/ac April 18	Glyphosate 540 1L/ac & AIM 35mL/ac May 13	Bonanza 480EC 0.69L/ac and StartUp 0.67L/ac May 21	RoundUp 0.67L/ac May 26	RoundUp Weathermax 0.67L/ac May 24
Stubble	Durum	Wheat	Wheat	Oats	Canaryseed
Row Spacing (cm)	21cm	25cm	30cm	30cm	30cm
Plot size (m²)	10.8m ²	12.2m ²	16.5m ²	9.2m ²	25.6m ²
Seed date	13-May	16-May	22-May	26-May	26-May
Kg N-P-K-S/ha	112-56-0-22	140-22-0-5	155-51-0-19	96-32-13-0 at seeding(broadcast additional 16 kg of N/ha July 4)	145-40-20-20
in-crop herbicide	Centurion 75mL/ac June 5; Liberty 1.62L/ac June 20	Liberty 1.62L/ac & Centurion 75mL/ac June 17	Liberty 1.35L/ac & Facet L 227mL/ac June 20	Liberty 1.35L/ac June 26	Liberty 1.35L/ac & Centurion ADV 150mL/ac June 15 & June 27
Plant counts	12-Jun	11-Jun	11-Jun	26-Jun	17-Jun
Foliar Micros	24-Jun	01-Jul	01-Jul	04-Jul	08-Jul
Tissue collection	08-Jul	15-Jul	15-Jul	06-Aug	24-Jul
Maturity	20-Aug	August 22-31	September 5-8	September 5-8	September 4-5
Insecticide	Voliam Xpress 91mL/ac for low flea beetle pressure	None	None	None	Decis 5EC 80mL/ac July 12 for Cabagge Seedpod Weevil

Fungicide	None	Cotegra 280mL/ac July 7	Cotegra 283mL/ac July 10	None	Cotegra 280 mL/ac July 16
Desiccant	Reglone 0.69L/ac August 20	Reglone ION 0.83L/ac Sept 5	StartUp 0.67L/ac Sept 8	None	RoundUp Weathermax 0.67L/ac Max Sept 8
Harvest date	02-Sep	14-Sep	25-Sep	24-Sep	19-Sep

Data collection at all sites consisted of environmental conditions, soil sampling, stand establishment, tissue testing, days to maturity, seed yield, and oil. Weather data was collected at each site from a nearby weather station to collect average temperatures (°C) and total precipitation (mm) for the growing season months of May through August. Soil samples were taken in the spring for the general trial area from 0 to 6-inch (0-15cm) depths and 6 to 24-inch (15-60cm) depths from the trial area. Soil sample results were used to determine recommendations for NPKS fertility and to demonstrate whether B, Cu, and/or Zn were limiting in the soil at each location. Stand establishment was measured by counting the seedlings along four 1-meter sections of crop row per plot. The counted plants were converted into plants/m² equivalents. Days to maturity was evaluated by documenting the calendar date in which the majority of plants in a plot reached 60% seed colour change. The date of seeding was subtracted from the maturity date to determine the number of days to maturity. Grain yield was determined at each site by weighing each harvested plot sample and converting the grams per plot to a kg/ha equivalent, while correcting to a consistent moisture of 10%. Oil was determined by completing NIR analysis from a cleaned subsample of every harvested plot. Lastly, statistical analyses were completed for each site separately using randomized complete block in the Statistix 10 software.

Results *(you must provide the following information)*

Present and discuss any project results, including any data or measurements taken to evaluate the demonstration. Include things that didn't appear to work. These results are just as important to share. List extension activities such as field days or workshops. List the activity, the date it occurred, and the number of people who attended.

Environmental Conditions:

The environmental conditions of 2025 were marked by dry to relatively normal precipitation (55-120% of long-term average) at all sites with near normal to slightly higher average growing season temperatures (+0.1-1.0°C) (Table 3). All sites experienced below-average rainfall in May, with much higher average temperatures. The northern locations of Scott and Melfort were the driest locations in May, only receiving total precipitation of 12mm and 5mm, respectively. The more southern sites of Yorkton, Swift Current, Redvers and Indian Head experienced greater amounts of precipitation in comparison, of 24-65mm, although these amounts were still below the long-term averages at all sites, except Redvers. In June, most sites had near normal temperatures, with below average precipitation at Yorkton, Swift Current, Redvers and Indian Head, and above average precipitation at Scott and Melfort. July was cooler, with reduced precipitation at all locations, while August was much warmer with greater precipitation at all locations, except for at Indian Head and Redvers. Overall, conditions were good for canola growth and yield at all sites, where canola plots were successfully established and harvested.

Table 3. Total precipitation (mm) and average temperatures (°C) from May through August of 2025 as compared to their respective long-term averages at Swift Current, Scott, Melfort, Redvers, and Indian Head, SK.

	May	June	July	August	Average/Total
--Temperature(°C)--					
Swift Current	13.1	15.9	18.0	19.0	16.5
Long-Term	11.9	16.4	19.1	18.7	16.5
Scott	12.9	14.6	15.8	17.4	15.2
Long-term	10.8	14.8	17.3	16.3	14.8
Melfort	13.8	15.0	17.0	18.0	16.0
Long-term	10.1	15.2	17.8	16.7	15.0
Redvers	13.1	16.2	17.5	17.9	16.2
Long-term	11.1	16.2	18.7	18.0	16.0
Indian Head	12.7	15.3	17.0	17.8	15.7
Long-term	10.8	15.8	18.2	17.4	15.6
--Precipitation(mm)--					
Swift Current	34.2	31.3	78.2	92.6	236.3 (120%)
Long-Term	47.5	56.0	56.3	38.0	197.8
Scott	11.8	103.7	28.7	64.5	208.7 (92%)
Long-term	38.9	69.7	69.4	48.7	226.7
Melfort	4.8	93.2	25.9	113.5	237.4 (104%)
Long-term	33.4	79.5	69.6	45.9	228.4
Redvers	65.0	27.0	80.0	40.0	212.0 (79%)
Long-term	60.0	95.2	65.5	46.6	267.3
Indian Head	42.6	39.4	27.1	26.9	136.0 (55%)
Long-term	51.7	77.4	63.8	51.2	244.1

Spring soil sample:

Spring soil sample results for micronutrients found at least one micronutrient (B, Cu or Zn) to be potentially limiting at every location in the demonstration (Table 4). At Swift Current (0.3ppm), Scott (0.2ppm), and Melfort (0.5ppm) boron levels in the soil were considered very low or low based on soil sample results. At Redvers (1.2ppm) boron levels were moderate, and at Indian Head (1.4ppm) they were considered high. No location had low copper levels; however, Scott (0.61ppm), Redvers (0.66ppm), Swift Current (0.8), and Melfort (1.02ppm) had levels that were moderate, whereas Indian Head (2.35ppm) had high levels of copper. For zinc, Swift Current (0.61ppm), Redvers (0.61ppm), and Indian Head (0.45ppm) had low levels, Scott (1.00ppm) had moderate levels, and Melfort (2.52ppm) had high levels. Based on these results, a response to boron fertilization would be most likely at Swift Current, Scott and Melfort. A response to copper would be quite low at all locations, but greatest at Scott and Redvers, and a response to zinc would be most likely at Indian Head, Redvers and Swift Current.

Table 4. Soil sample results for boron (B), copper (Cu), and zinc (Zn) for “Do micronutrients applied to canola actually increase yield?” at Swift Current, Scott, Melfort, Redvers, and Indian Head, SK in 2025.

	B	Cu	Zn
	ppm		
Swift Current	0.30	0.80	0.61
Scott	0.20	0.61	1.00
Melfort	0.50	1.02	2.52
Redvers	1.20	0.66	0.61
Indian Head	1.40	2.35	0.45

Stand establishment:

Stand establishment was greatest at Indian Head (70 plants/m²), followed by Scott (54 plants/m²), Swift Current (50 plants/m²), Redvers (49 plants/m²), and Melfort (48 plants/m²) (Table 5). Plant density was only significantly different between treatments at Scott (p=0.01). At Scott, foliar boron (62 plants/m²) was the only treatment to demonstrate a significant increase in plant stands as compared to the control (47 plants/m²). This result has very little agronomic significance, as foliar boron was applied after plant stands were evaluated, so this treatment would have been managed the same as the control when the canola plants were counted. Plant densities were not significantly affected by in-furrow applications of the micronutrients at any site, suggesting there were no adverse effects on establishment.

Table 5. Results of the Analysis of Variance and treatment means for plant density (plants/m²) in “Do micronutrients applied to canola actually increase yield?” at Swift Current, Scott, Melfort, Redvers, and Indian Head, SK in 2025. Letters signify treatments that are significantly different at p<0.05 using two-sided Dunnett’s multiple comparisons with the control.

	Swift Current	Scott	Melfort	Redvers	Indian Head
P-value	0.87	0.01	0.72	0.58	0.23
Grand Mean	50	54	48	49	70

CV	16.11		11.19		26.24		26.99		8.23	
<u>Treatments</u>										
Control	51	A	47	B	46	A	43	A	68	A
In-furrow Boron	54	A	56	B	39	A	49	A	72	A
Foliar Boron	48	A	62	A	53	A	44	A	71	A
In-furrow Copper	47	A	54	B	49	A	56	A	71	A
Foliar Copper	49	A	53	B	48	A	43	A	64	A
In-furrow Zinc	52	A	59	B	48	A	57	A	75	A
Foliar Zinc	48	A	46	B	53	A	49	A	71	A

Tissue Testing:

The results of tissue testing could not be statistically analyzed, as only composite samples per treatment were analyzed for micronutrient content. Therefore, treatment differences cannot be deemed significant or not.

Boron (B) was greatest at Redvers (80-112ppm), followed by Melfort (33-53ppm), Scott (26-47ppm), Swift Current (26-36ppm), and Indian Head (21-26ppm) (Table 6). At every site, tissue test results indicated an increase in B when B was applied as compared to the control, except for foliar B at Redvers. In-furrow B increased B in leaf tissue by 1ppm at Scott, 2ppm at Indian Head, 4ppm at Swift Current, 7ppm at Melfort, and 9ppm at Redvers. Foliar B increased B in leaf tissue by 1ppm at Swift Current, 4ppm at Indian Head, 8 ppm at Melfort and 18ppm at Scott. These results do not suggest that one method of B application was better than the other. Regardless of the average increase in B in leaf samples due to in-furrow and foliar applications, all treatments were within the sufficiency range reported by Agvise Laboratories of 15-54ppm, despite Swift Current, Scott and Melfort all demonstrating low soil B.

Table 6. Tissue sample results for boron (ppm) for “Do micronutrients applied to canola actually increase yield?” at Swift Current, Scott, Melfort, Redvers, and Indian Head, SK in 2025.

<u>Treatments</u>	Swift Current	Scott	Melfort	Redvers	Indian Head
Control	32	29	38	103	22
In-furrow Boron	36	30	45	112	24
Foliar Boron	33	47	53	101	26
In-furrow Copper	26	35	33	101	22
Foliar Copper	33	29	37	80	24
In-furrow Zinc	31	26	38	95	21
Foliar Zinc	32	28	39	102	23

Tissue test copper (Cu) was greatest at Indian Head (18-19ppm), followed by Swift Current (4-10 ppm), Scott (2-12ppm), Melfort (3-6ppm) and Redvers (2-3ppm) (Table 7). At all sites, tissue test results indicated an increase in Cu when Cu was applied as compared to the control, except for in-furrow Cu at Melfort and foliar Cu at Scott. In-furrow Cu increased Cu in leaf tissue by 1ppm at Redvers, Indian Head and Swift Current, and 10 ppm at Scott. Foliar Cu increased Cu in leaf tissue by 1ppm at Redvers and Indian Head, 3ppm at Melfort, and 6 ppm at Swift Current. These results do not suggest that one method of Cu application was better than the other. According to Agvise Laboratories, the Cu sufficiency range from leaf samples is 4-25ppm. Therefore, Swift Current and Indian Head were the only sites to have all leaf samples sufficient in Cu, which was not surprising, as both these locations had high to moderate Cu in their soils. At Scott, all samples except for in-furrow Cu were deficient, at Melfort, all samples except for foliar Cu were deficient, and at Redvers, all samples were deficient in Cu. Redvers, Scott, and Melfort had moderate soil test levels of Cu, so this result was surprising. Despite these results, there were still no yield responses to Cu at deficient sites.

Table 7. Tissue sample results for copper (ppm) for “Do micronutrients applied to canola actually increase yield?” at Swift Current, Scott, Melfort, Redvers, and Indian Head, SK in 2025.

<i>Treatments</i>	Swift Current	Scott	Melfort	Redvers	Indian Head
Control	4	2	3	2	18
In-furrow Boron	4	3	3	2	18
Foliar Boron	7	3	3	3	18
In-furrow Copper	5	12	3	3	19
Foliar Copper	10	2	6	3	19
In-furrow Zinc	4	2	3	3	18
Foliar Zinc	4	2	3	2	18

Zinc (Zn) was greatest in leaf concentrations at Melfort (28-38ppm), followed by Scott (25-34ppm), Swift Current (22-32ppm), Indian Head (17-21ppm) and Redvers (15-31ppm) (Table 8). At all sites, tissue test results indicated an increase in Zn when Zn was applied as compared to the control, except for in-furrow Zn at Indian Head. In-furrow Zn increased tissue Zn by 3ppm at Swift Current, 5ppm at Melfort, 7ppm at Scott, and 15ppm at Redvers as compared to the control. Foliar Zn increased tissue Zn by 1ppm at Indian Head and Scott, 5ppm at Redvers, 7ppm at Swift Current and 8ppm at Melfort as compared to the control. According to Agvise Laboratories, sufficiency levels for Zn in tissue samples are 22 to 49ppm. Therefore, all treatments at Indian Head were deficient in Zn, and all samples except for in-furrow Zn were deficient at Redvers. These two locations had Zn deficiencies in their soils, so this result was not surprising. However, Swift Current also had a deficiency of Zn in their soil, but tissue samples were all within the sufficiency range. Melfort and Scott also had all treatments with sufficient Zn in tissue samples; however, soils at Melfort and Redvers were moderate to high in Zn.

Table 8. Tissue sample results for zinc (ppm) for “Do micronutrients applied to canola actually increase yield?” at Swift Current, Scott, Melfort, Redvers, and Indian Head, SK in 2025.

<i>Treatments</i>	Swift Current	Scott	Melfort	Redvers	Indian Head
Control	25	27	30	16	20
In-furrow Boron	22	26	28	16	19
Foliar Boron	26	27	32	15	17
In-furrow Copper	28	31	31	16	20
Foliar Copper	28	25	29	19	18
In-furrow Zinc	28	34	35	31	19
Foliar Zinc	32	28	38	21	21

Maturity:

Maturity was not significantly different between treatments at any site (Table 9). Overall, days to maturity were greatest at Melfort (107 days), followed by Scott (103 days), Redvers (103 days), Indian Head (101 days), and Swift Current (100 days).

Table 9. Results of the Analysis of Variance and treatment means for maturity (Days to) in “Do micronutrients applied to canola actually increase yield?” at Swift Current, Scott, Melfort, Redvers, and Indian Head, SK in 2025. Letters signify treatments that are not significantly different at $p < 0.05$ using two-sided Dunnett’s multiple comparisons with the control.

	Swift Current		Scott		Melfort		Redvers		Indian Head	
P-value	0.75		0.95		0.85		0.72		0.46	
Grand Mean	100		103		107		103		101	
CV	0.75		2.16		1.48		1.00		0.49	
<i>Treatments</i>										
Control	101	A	103	A	107	A	103	A	101	A
In-furrow Boron	101	A	102	A	107	A	103	A	102	A
Foliar Boron	100	A	102	A	107	A	103	A	101	A
In-furrow Copper	101	A	103	A	108	A	103	A	101	A
Foliar Copper	100	A	103	A	108	A	104	A	102	A
In-furrow Zinc	100	A	104	A	107	A	104	A	101	A
Foliar Zinc	100	A	103	A	106	A	103	A	101	A

Grain yield:

Grain yield was not significantly different between treatments at any site (Table 10). Overall, grain yield was greatest at Scott (3526 kg/ha) followed by Indian Head (3211 kg/ha), Melfort (3182 kg/ha), Redvers (2387 kg/ha), and Swift Current (1993 kg/ha)

Table 10. Results of the Analysis of Variance and treatment means for grain yield (kg/ha) in “Do micronutrients applied to canola actually increase yield?” at Swift Current, Scott, Melfort, Redvers, and Indian Head, SK in 2025. Letters signify treatments that are not significantly different at $p < 0.05$ using two-sided Dunnett’s multiple comparisons with the control.

	Swift Current		Scott		Melfort		Redvers		Indian Head	
P-value	0.11		0.15		0.96		0.73		0.43	
Grand Mean	1993		3526		3182		2387		3211	
CV	10.35		2.34		8.27		6.06		1.86	
<i>Treatments</i>										
Control	1845	A	3483	A	3155.7	A	2346	A	3238	A
In-furrow Boron	1931	A	3526	A	3268.2	A	2456	A	3171	A
Foliar Boron	1885	A	3482	A	3263.5	A	2367	A	3204	A
In-furrow Copper	2247	A	3450	A	3103.1	A	2306	A	3253	A
Foliar Copper	1888	A	3577	A	3176.9	A	2415	A	3195	A
In-furrow Zinc	2128	A	3583	A	3121.6	A	2369	A	3185	A
Foliar Zinc	2027	A	3584	A	3184	A	2450	A	3232	A

Oil:

Oil was not significantly different between treatments at any site (Table 11). Overall, oil was greatest at Scott (50.5%) followed by Redvers (44.5%), Swift Current (44.5%), Indian Head (44.1%) and Melfort (43.7%).

Table 11. Results of the Analysis of Variance and treatment means for oil (%) in “Do micronutrients applied to canola actually increase yield?” at Swift Current, Scott, Melfort, Redvers, and Indian Head, SK in 2025. Letters signify treatments that are not significantly different at $p < 0.05$ using two-sided Dunnett’s multiple comparisons with the control.

	Swift Current		Scott		Melfort		Redvers		Indian Head	
P-value	0.21		0.17		0.67		0.56		0.19	
Grand Mean	44.5		50.5		43.7		44.5		44.1	
CV	1.89		0.66		0.83		0.81		0.58	
<i>Treatments</i>										
Control	43.5	A	50.4	A	43.7	A	44.6	A	44.3	A
In-furrow Boron	44.3	A	50.8	A	43.4	A	44.8	A	44.4	A
Foliar Boron	44.3	A	50.6	A	43.7	A	44.4	A	43.9	A
In-furrow Copper	45.0	A	50.7	A	43.8	A	44.4	A	44.0	A
Foliar Copper	44.5	A	50.2	A	43.9	A	44.5	A	44.2	A
In-furrow Zinc	45.1	A	50.3	A	43.9	A	44.3	A	44.2	A
Foliar Zinc	44.6	A	50.3	A	43.7	A	44.5	A	44.0	A

Conclusions and Recommendations

Describe what was learned from the demonstration. Highlight any significant conclusions and provide recommendations for the application and adoption of the project results. Be sure that you have presented the relevant data to support your conclusions. Identify any further research, development and communication needs, if applicable.

Overall, canola showed very little response to in-furrow and foliar applications of the micronutrients B, Cu and Zn at Melfort, Redvers, Scott, Swift Current and Indian Head, SK in 2025. Despite low soil B at three locations, tissue test results came back for all sites and treatments as sufficient. In contrast, all sites had moderate to high Cu in their soils based on spring sampling; however, sites with moderate soil Cu had multiple treatments deficient in plant tissue Cu from results of tissue testing. For Zn, Indian Head and Redvers, both had tissue tests where the majority of treatments were beneath sufficiency range, which was not surprising, as both locations had soils deficient in Zn; however, Swift Current also had Zn deficiency in their soil, but all treatments came back with sufficient Zn in their tissue samples. The overall effect of micronutrient applications was hard to evaluate on tissue sample results as statistical analysis could not be conducted as composite samples were collected. However, at every location, applications of B, Cu, or Zn did tend to increase the ppm of each respective nutrient in the tissue samples in relation to the control. Despite low tissue levels of micronutrients at some locations and micronutrient applications often increasing tissue levels of B, Cu, and Zn, there were never any significant differences for plant density, days to maturity, grain yield and oil of canola. These results suggest that regardless of low soil test and tissue test results for B, Cu, and Zn, canola is unlikely to demonstrate significant responses to in-furrow and foliar applications in SK. While it is advised for farmers and agronomists to monitor soils and crops for potential deficiencies as responses can be extremely site and year specific, preventative micronutrient applications across broad acres cannot be recommended based on the results of this demonstration.

Sustainable Canadian Agricultural Partnership (Sustainable CAP) Performance Indicators

a) List of performance indicators

Sustainable CAP Indicator	Total Number
Scientific publications from this project (List the publications under section b)	
• Published	0
• Accepted for publication	0
Highly Qualified Personnel (HQPs) trained during this project	
• Master's students	0
• PhD students	0
• Post docs	0
Knowledge transfer products developed based on this project (presentations, brochures, factsheets, flyers, guides, extension articles, podcasts, videos) ¹ . List the knowledge transfer products under section (c)	9

¹ Please only include the number of unique knowledge transfer products.

b) List of scientific journal articles published/accepted for publication from this project. Please ensure that each line includes the following: **Title, Author(s), Journal, Date Published or Accepted for Publication and Link to Article (if available)**. Add additional lines as needed.

1.
2.

3.
4.

c) List of knowledge transfer products/activities developed from this project.

Knowledge Transfer Product or Activity	Event/Location Where Knowledge Transfer Was Conducted	Estimated Number of Producers Participated in Knowledge Transfer	Link (if available)
17th Annual NE Ag Update	Kerry Vickar Centre, Melfort, SK: Feb 3, 2026	~80	https://www.agupdate.ca/
NARF & AAFC Joint Annual Field Day	Melfort Research Farm: July 23, 2025	126	https://neag.ca/events/
NARF & AAFC Niche/Minor Crops Tour	Melfort Research Farm: July 24, 2025	36	https://neag.ca/events/
WCA Annual Field Tour	Swift Current July 17, 2025	85	
WARC Annual Field Day	WARC Research Farm, Scott, SK: July 9, 2025	150	
SERF Annual Field Day	South East Research Farm, Redvers, SK: July 10, 2025	Approx. 80	
Indian Head Crop Management Field Day	Indian Head, SK: Jul 15, 2025	157	https://iharf.ca/indian-head-crop-management-field-day/
Chris Holzapfel: Applied Fertility Research Highlights: N, P, and Beyond	AGVISE Laboratories 36th Annual Soil Fertility Seminar / Portage la Prairie, MB:	TBD	https://www.agvise.com/resources/seminars-and-events/

	Mar 3, 2026		
Chris Holzapfel: Applied Fertility Research Highlights: N, P, and Beyond	AGVISE Laboratories 36th Annual Soil Fertility Seminar / Saskatoon, SK: Mar 5, 2026	TBD	https://www.agvise.com/resources/seminars-and-events/

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Appendices

Include any additional materials supporting the previous sections, e.g. detailed data tables, maps, graphs, specifications, literature cited (Use a consistent reference style throughout).

Table 12. Soil residual information for “Do micronutrients applied to canola actually increase yield?” at Swift Current, Scott, Melfort, Redvers, and Indian Head, SK in 2025.

Depth	NO ₃ -N (kg/ha)	Olsen- P (ppm)	K (ppm)	S (kg/ha)	pH	Organic Matter (%)	Salts (mmho/cm)
Swift Current							
0-15cm	17	22	326	20	5.9	2.9	0.21
15-60cm	67			61	7.6		0.34
Scott							
0-15cm	19	13	176	18	5	3.6	0.17
15-60cm	17			81	7.7		0.31
Melfort							
0-15cm	10	12	420	7	6	9.8	0.28
15-30cm	37			34	7.5		0.60
Redvers							
0-15cm	30	8	213	13	8.2	3.6	0.33

15-60cm	57		47	8.6		0.35
Indian Head						
0-15cm	9	7	569	7	8	4.6
15-60cm	13			34	8.2	0.51

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Expenditure Statement

You must provide an expenditure statement showing how ADOPT funds were used. Expenditures must be reported using the budget categories shown in Appendix B of your contract. We recommend that you report your expenditures using the Excel spreadsheet we have developed for this purpose (ADOPT Expenditure Statement.xls). That spreadsheet is available from the research branch project manager or the evaluation coordinator.

Note that the ADOPT contract requires you to retain all receipts and financial records relating to the project for at least six years after the project is completed.

See attached Excel Spreadsheet