

2025 Final Report
for the
Saskatchewan Oilseeds Development Commission
Canola Agronomic Research Program

Project Title: Potassium chloride (KCl) replacements for chlorine uptake in canola



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1. Project Identification

Project Title: Potassium chloride (KCl) replacements for chlorine uptake in canola

Project Number: #20241060

Producer Group Sponsoring the Project: Saskatchewan Oilseeds Development Commission

Project Location(s):

- Western Applied Research Corporation (WARC), Scott, SK. RM #308
- Indian Head Agricultural Research Foundation (IHARF), Indian Head, SK. RM #156
- Wheatland Conservation Area (WCA), Swift Current, SK. RM #137
- Irrigation Saskatchewan (ISASK), Outlook, SK. RM #284

Project start and end dates (month & year): February 25, 2025 – March 30, 2025

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2. Objectives and Rationale

Project Objectives:

To identify and display new and different products used to apply potassium and chloride in Canola across the province. Outline products that provide chloride to canola without the use of potassium chloride (KCl). Compare and contrast different rates and timings of side-band and foliar applied chloride products to the traditional method of applied KCl. To investigate the useability and general wear and tear of chloride products on farm equipment.

Rationale:

Chlorine, one of the 14 essential nutrients required by canola (Canola Council, 2022), plays an important role in the development of the plant over a growing season. Chlorine uptake by canola is done in its ionic form, chloride (Cl^-). As one of the essential micronutrients, chloride is not in large demand but will cause deficiency symptoms when not present. Chloride plays a major role in photosynthesis, charge balance, enzyme activation, stomatal regulation and disease resistance in canola (Canola Council, 2022). As a highly mobile nutrient in the soil, Cl^- is readily available and easily absorbed by the roots. Chlorine deficiency, although uncommon, is displayed by stunting, yellowing or chlorotic leaves, bronzing in extreme cases and root stunting. Typically, canola requires about 0.8 kg/ha chloride to reach the yield potential of 35 bu/ac (Canola Council of Canada, 2024) which can be hard to acquire with limited densities of Cl^- in most products.

Although potassium is present in many Saskatchewan soils “it is estimated that approximately one million acres are potassium deficient” (Government of Saskatchewan, n.d.). Many factors can affect potassium deficiencies as soil tests can display adequate levels of K, but crops will still respond to fertilization. K deficiencies are most likely to occur in northern Saskatchewan or sandy loam or peat soils. Forage production will also cause a potassium deficiency as continued removal of straw will deplete the soil. It is predicted that usually, less than 2 percent of the total K is plant available. Potassium is used in many plant functions and deficiencies will result in symptoms such as slow growth, poor water use efficiency, lodging, lower yields, poor nitrogen uptake, disease susceptibility and small shrivelled seed.

Research by Colmenero-Flores, et al. (2019) suggests that some crops might use larger amounts of chloride than previously understood. Colmenero-Flores, et al. (2019) suggests that Cl^- may be a macronutrient to many plants. This study found that there are genomes that make certain varieties utilize Cl^- in more ways. A separate study found that the addition of chlorine to canola seedlings had promising results. It found that increasing Cl^- levels in the soil increased plant growth, photosynthetic pigment and water use efficiency at rates of 25, 50, 75, and 100 mmol/L chloride (Hu Xiao-wan, et al., 2012). It was found that the highest increase in dry plant biomass at 9 and 18 days after application was with the Cl^- application of 50 mmol/L. It was also observed that applications of 200 mmol/L were detrimental to plant growth, biomass and chlorophyll content.

The use of KCl fertilizers is widespread, and the most common source of Cl⁻ for Saskatchewan producers. Chloride facilitates many important functions in the plant such as controlling water loss, maintaining turgor pressure and photosynthesis. There have been accounts of the addition of Cl⁻ reducing the risk of some root rots and leaf diseases. Chloride also increases the transportation of K, Ca and Mg in the plant and can also impact nitrogen uptake (Government of Saskatchewan, n.d.). Some areas are extremely deficient in Cl⁻ and may benefit from added Cl⁻ in the plant. For example, the annual spring soil tests at Scott are always considered very deficient, this year testing 8 lbs/ac Cl⁻ at 0-24" depths. KCl, 0-0-60, fertilizer can be harsh on equipment and cause unnecessary wear and tear. It is important to provide producers with strategies for managing Cl⁻ deficiencies in canola that follow 4R practices and save the longevity of their equipment. This is particularly important as there are not many Cl⁻ products available for producers and choosing the correct solution is complicated. With the research previously stated, early-season and mid-season Cl⁻ applications may create strong returns for producers on their canola.

3. Methodology and Results

Methodology:

Methodology

This project was set up in an RCBD with 4 replications. Canola was be seeded at 115 seeds/m² at Indian Head and 110 seeds/m² at the rest of the sites. The base fertility was decided to be non-limiting for nitrogen (N), phosphorus (P), and sulfur (S) according to spring soil test results at each site. Potassium (K) fertilizer rates varied between 13 lbs K₂O/ac and 26 lbs K₂O/ac based on the treatments. The untreated check had a base N, P, and S fertility with no additional K or micronutrient fertilizers. KCl (0-0-60) fertilizer was an industry check for all of the potassium products. Pegasus, a granular KCl fertilizer will be compared to the industry standard of KCl. K-Mag Premium is to be used as a replacement for KCl fertilizers and contains substantially less chloride (Cl⁻) in the formulation than potash or potassium chloride (KCl). The fourth potassium replacement product used was Aspire, with trace amounts of Cl⁻ and 0.5% boron (B). All spring fertility will be placed in the sideband below the seed.

Table 1. Treatment list for “Potassium chloride replacements for chlorine uptake in canola” in Scott, Indian Head, Swift Current and Outlook, SK in 2025.

Treatment No.	Product	Rate (Actual lbs K₂O/ac)
1	Untreated Check	
2	KCl (0-0-60)	13
3	KCl (0-0-60)	26
4	Pegasus	13
5	Pegasus	26
6	K-Mag Premium	13
7	K-Mag Premium	26
8	Aspire	13
9	Aspire	26

Seeding took place at each location between May 8th in Swift Current and June 2nd in Outlook. All trials were seeded into various cereal crop stubble at a seeding rate of 4.5 lbs/ac in Scott, Outlook and Swift Current and 5 lbs/ac in Indian Head. A popular regionally-specific high yielding glufosinate tolerant canola variety was seeded at a depth of ¾–7/8 in, with row spacing of 8.25 in at Swift Current, 10 in at Scott and Outlook, and 12 in at Indian Head. Each site’s base fertility was prescribed to be non-limiting for crop growth, using the spring soil samples to validate N, P, and S values. A pre-emergent herbicide burn down was completed at each site prior to seeding. In-crop herbicide applications consisting of Liberty 150SN and varying tank mixes occurred on June 15th in Indian Head, 17th at Scott and 20th at Swift Current & Outlook. A second herbicide application of Liberty 150 SN, Centurion ADV and Valid was done at Indian Head on June 27th. An insecticide application was required at Indian Head and Swift Current. Indian Head applied Desis 5 EC at 80 mL/ac for the suppression of cabbage seedpod weevil populations, while Swift Current applied Volaim Xpress at 90 mL/ac as preventative measures. Cotegra fungicide was applied at all sites except for Swift Current, as conditions were not conducive to disease development. The trial was desiccated with Reglone ION in Scott, Outlook and Swift Current and Roundup Weathermax in Indian Head. Harvest of each location took place on Sept 4, 14, 20 and Oct 1st in Swift Current, Scott, Indian Head and Outlook, respectively.

Data Collection

Each site collected spring soil samples prior to seeding to analyze the background overall soil residual content of common nutrients, Scott, Indian Head and Swift Current also requested extra chloride analysis. Plant density counts were conducted by counting 4 x 1m rows lengths per plot at each location in early June. The Canopeo app was used to calculate percent (%) canopy closure of each plot at bud formation stage, prior to bolting and canopy closure. This was done by collecting one photo of a representative area within the centre of the plot and submitting it into the app for analysis. Tissue test for K and Cl⁻ analysis, for the majority of the sites, were collected at the same time as canopy closure around canola rosette stage. Each trial location was harvested in early to mid September by small plot combine and yield was weighed and retained for grain analysis. Seed protein and oil content was determined at each site by using an NIR protein machine. Each site completed their own test weight analysis, determined following CGC recommended procedures. Daily weather was collected at each location by an on-site weather station. Long-term weather data was collected from Environment Canada (1985-2014).

Results:

Soil Samples

Soil sampling across the four locations highlights clear differences in soil fertility, texture, and salt-related indicators that are consistent with their respective soil zones. Scott (Dark Brown soil zone) showed moderate residual nitrate levels (32 lb/ac total to 24"), adequate sulphur, and moderate potassium, with relatively low chloride at 12 lb/ac (0–24"), indicating minimal salinity risk. Indian Head, located in the Black soil zone, had lower residual nitrate and sulphur in the surface but very high potassium and organic matter, along with a high cation exchange capacity, reflecting its heavier, more fertile soils; however, chloride levels were notably higher at 36 lb/ac, suggesting localized salt accumulation that could influence sensitive crops under dry conditions. Outlook's soil test indicates strong fertility potential, with relatively high nitrate-N through the profile, adequate Olsen P, moderate K, and very high sulphur reserves, despite lower organic matter typical of Dark Brown soils. Chloride was not tested at the Outlook site, so no assessment of Cl fertility can be made for this location. Swift Current, in the Brown soil zone, had higher subsoil nitrate and sulphur reserves, moderate phosphorus and potassium, and low organic matter, with chloride remaining low at 8 lb/ac, indicating little salinity concern. Overall, chloride levels were

low to moderate across sites, with Indian Head standing out as the only location where chloride warrants closer monitoring, particularly in dry years when salt concentration effects can be amplified.

Climate Conditions

During the 2025 crop growing season, temperatures across Scott, Indian Head, Outlook, and Swift Current were generally moderate and close to long-term norms, with some periods warmer than average. At Scott, the April–September average temperature was 13.6 °C, approximately 110% of the long-term average, reflecting a warm April and an especially warm September, while mid-summer temperatures remained near normal. Indian Head experienced one of the most typical seasons, averaging 15.7 °C (101% of normal), with temperatures closely tracking long-term values throughout the summer months. At Outlook, the growing season averaged 14.6 °C, slightly above the long-term mean of 13.6 °C, with warmer conditions in August and September offsetting near-normal early summer temperatures. Swift Current averaged 14.8 °C (106% of normal), and despite prolonged dry conditions, temperatures remained moderate through most of the summer, with only a few days exceeding 30 °C around the July long weekend. Overall, heat stress during flowering and grain fill in 2025 was limited across all locations; however, crop development and final yield outcomes were influenced more strongly by precipitation timing and soil moisture availability than by temperature extremes, particularly in the drier Swift Current region.

During the 2025 crop growing season, precipitation patterns varied widely across Scott, Indian Head, Outlook, and Swift Current, with timing playing a larger role than total amounts in crop performance. At Scott, total growing season precipitation was near normal (279.5 mm, 101% of the long-term average), but rainfall was highly uneven, with very dry conditions in April and May followed by excessive moisture in June and above-normal rainfall continuing through August and September. Indian Head experienced a markedly dry season, receiving only 136.0 mm from April to September (56% of normal), with persistent moisture deficits through much of the summer limiting yield potential despite some late-season rainfall. At Outlook, total precipitation exceeded the long-term average (233.5 mm, 133% of normal), largely driven by strong June through August rainfall; however, a very dry May and an extremely dry September, combined with reliance on irrigation, influenced crop development and late-season maturity. Swift Current received 276.6

mm over the growing season (110% of normal), but early spring moisture in April was followed by sparse rainfall through May and June, resulting in crops being seeded into adequate but not excessive moisture. Conditions remained dry until significant rains arrived in late July and early August, which were beneficial for later-seeded crops but too late for many early-seeded and fall-seeded cereals, contributing to secondary growth, delayed maturity, quality issues, and a slow harvest that extended into mid-October, compounded by the driest September on record.

Plant Density

Scott

Plant density differed significantly among treatments ($p = 0.0383$), indicating that potassium source and rate influenced early crop establishment. The highest plant density was observed with Aspire at 13 lbs K_2O/ac (66 plants/ ft^2), which was statistically greater than several other treatments and ranked in the “A” group, suggesting improved establishment under this treatment. Most other fertilizer treatments, including KCl, Pegasus, and K-Mag Premium at both rates, produced intermediate plant densities (AB group) ranging from 51–56 plants/ ft^2 , indicating similar performance among these potassium sources. The untreated check and Pegasus at 13 lbs K_2O/ac had the lowest plant densities (49 and 47 plants/ ft^2 respectively), both in the “B” group. Overall, there was a trend toward improved plant density with potassium fertilization compared to the untreated check, with Aspire at the lower rate showing the strongest response, while increasing potassium rate did not consistently increase plant density across products.

Table 2. Plant density results for “Potassium chloride replacements for chlorine uptake in canola” in Scott, SK in 2025.

Trt No.	Product	Rate (Actual lbs K_2O/ac)	Plant Density (plants/ ft^2)	
1	Untreated Check	0	49	B
2	KCl (0-0-60)	13	52	AB
3	KCl (0-0-60)	26	56	AB
4	Pegasus	13	47	B
5	Pegasus	26	51	AB
6	K-Mag Premium	13	56	AB
7	K-Mag Premium	26	54	AB
8	Aspire	13	66	A
9	Aspire	26	54	AB
p-value			0.0383	

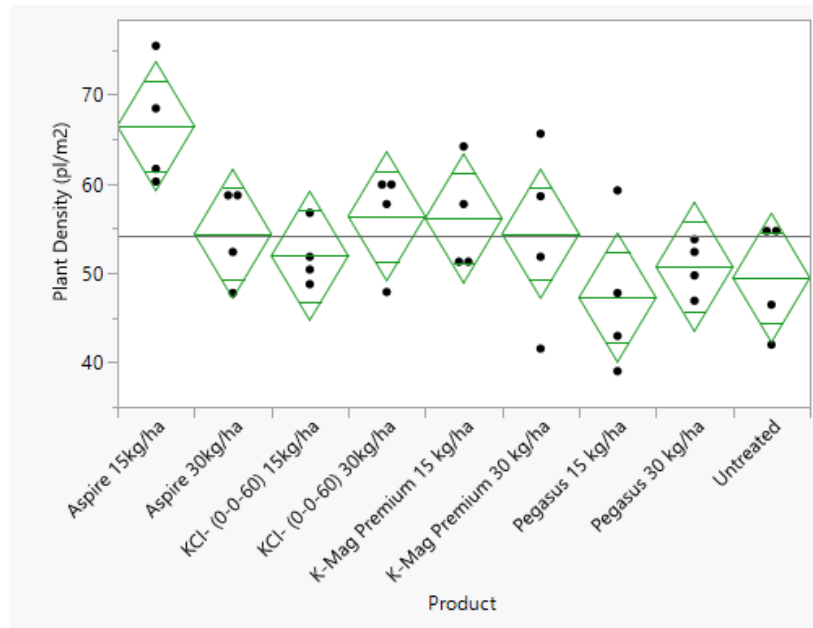


Figure 1. Plant density results for “Potassium chloride replacements for chlorine uptake in canola” in Scott, SK in 2025.

Indian Head

Plant density did not differ significantly among treatments ($p = 0.5877$), indicating that potassium source or application rate had no measurable effect on crop establishment in this trial. Plant densities were relatively consistent across treatments, ranging from 68 to 79 plants/ft², and all treatments fell within the same statistical group (“A”). Although KCl at 26 lbs K₂O/ac (79 plants/ft²) and K-Mag Premium at 13 lbs K₂O/ac (78 plants/ft²) showed numerically higher plant densities, these differences were not statistically significant. Overall, the results suggest that potassium fertilization, regardless of product or rate, did not influence plant stand in this environment, and emergence was likely driven more by seeding conditions and environmental factors than by potassium treatment.

Table 3. Plant density results for “Potassium chloride replacements for chlorine uptake in canola” in Indian Head, SK in 2025.

Trt No.	Product	Rate (Actual lbs K ₂ O/ac)	Plant Density (plants/ft ²)	
1	Untreated Check	0	71	A
2	KCl (0-0-60)	13	72	A
3	KCl (0-0-60)	26	79	A
4	Pegasus	13	71	A
5	Pegasus	26	71	A
6	K-Mag Premium	13	78	A
7	K-Mag Premium	26	71	A
8	Aspire	13	68	A
9	Aspire	26	77	A
p-value			0.5877	

Swift Current

Plant density differed significantly among treatments ($p = 0.0137$), suggesting that potassium source and rate influenced crop establishment in this trial. The highest plant density was observed with Pegasus at 26 lbs K₂O/ac (47 plants/ft²), which ranked in the “A” group and was significantly greater than the untreated check (32 plants/ft²), which fell into the “B” group. Most other treatments, including KCl, K-Mag Premium, and Aspire at both rates, produced intermediate plant densities ranging from 36–43 plants/ft² and were classified in the “AB” group, indicating they were not statistically different from either the top or lowest treatment. Overall, there was a trend toward improved plant density with potassium fertilization compared to the untreated check, with the strongest response observed for Pegasus at the higher rate, while other products and rates showed moderate but statistically similar establishment levels.

Table 4. Plant density results for “Potassium chloride replacements for chlorine uptake in canola” in Swift Current, SK in 2025.

Trt No.	Product	Rate (Actual lbs K ₂ O/ac)	Plant Density (plants/ft ²)	
1	Untreated Check	0	32	B
2	KCl (0-0-60)	13	37	AB
3	KCl (0-0-60)	26	42	AB
4	Pegasus	13	43	AB
5	Pegasus	26	47	A
6	K-Mag Premium	13	36	AB
7	K-Mag Premium	26	38	AB
8	Aspire	13	38	AB
9	Aspire	26	39	AB
p-value			0.0137	

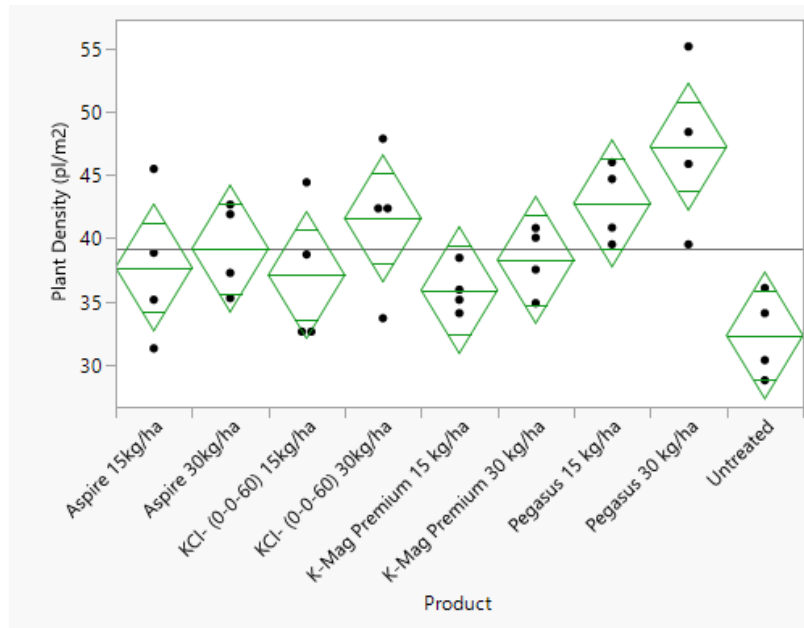


Figure 2. Plant density results for “Potassium chloride replacements for chlorine uptake in canola” in Swift Current, SK in 2025.

Outlook

Plant density did not differ significantly among treatments ($p = 0.8605$), indicating that potassium source and application rate had no measurable effect on crop establishment at this site. Plant densities varied numerically from 28 to 49 plants/ft², but all treatments were classified within the same statistical group (“A”), suggesting these differences were due to normal field variability rather than treatment effects. While KCl at 26 lbs K₂O/ac (49 plants/ft²) and the untreated check (46 plants/ft²) showed the highest plant densities numerically, and Pegasus at 26 lbs K₂O/ac (28 plants/ft²) was the lowest, these differences were not statistically significant. Overall, the results indicate that potassium fertilization did not influence plant stand under the conditions of this trial, with emergence likely driven more by environmental and seeding conditions.

Table 5. Plant density results for “Potassium chloride replacements for chlorine uptake in canola” in Outlook, SK in 2025.

Trt No.	Product	Rate (Actual lbs K ₂ O/ac)	Plant Density (plants/ft ²)	
1	Untreated Check	0	46	A
2	KCl (0-0-60)	13	37	A
3	KCl (0-0-60)	26	49	A
4	Pegasus	13	41	A
5	Pegasus	26	28	A
6	K-Mag Premium	13	45	A
7	K-Mag Premium	26	36	A
8	Aspire	13	43	A
9	Aspire	26	42	A
p-value			0.8605	

Combined Results

When data from all sites were combined, plant density did not differ significantly among potassium treatments ($p = 0.4568$), indicating that potassium source and application rate had no consistent effect on crop establishment across environments. Plant densities were relatively uniform among treatments, ranging from 50 to 57 plants/ft², and all treatments fell within the same statistical group (“A”). Although KCl at 26 lbs K₂O/ac (57 plants/ft²) showed the highest numerical plant density, and K-Mag Premium and Aspire treatments were also slightly higher than several others, these differences were not statistically significant. Overall, the combined results suggest that potassium fertilization did not consistently influence plant stand across sites, and variability in plant density was more likely driven by site conditions, environmental factors, and seeding conditions rather than potassium source or rate.

Table 6. Plant density results for “Potassium chloride replacements for chlorine uptake in canola” in Scott, Indian Head, Swift Current and Outlook, SK in 2025.

Trt No.	Product	Rate (Actual lbs K ₂ O/ac)	Plant Density (plants/ft ²)	
1	Untreated Check	0	50	A
2	KCl (0-0-60)	13	50	A
3	KCl (0-0-60)	26	57	A
4	Pegasus	13	51	A
5	Pegasus	26	50	A
6	K-Mag Premium	13	54	A
7	K-Mag Premium	26	50	A
8	Aspire	13	54	A
9	Aspire	26	53	A
p-value			0.4568	

Canopy Closure

Scott

Canopy closure did not differ significantly among potassium treatments ($p = 0.7542$), indicating that potassium source and application rate had no measurable effect on canopy development at this site. Canopy closure values ranged from 7.70 to 11.20, but all treatments were grouped within the same statistical category (“A”), suggesting that observed differences were due to normal field variability rather than treatment effects. Numerically, Aspire at 26 lbs K_2O/ac (11.20) and K-Mag Premium at 13 lbs K_2O/ac (10.89) showed the highest canopy closure values, while KCl at 26 lbs K_2O/ac (7.70) and Pegasus at 13 lbs K_2O/ac (7.73) were the lowest. Overall, the results indicate that potassium fertilization did not significantly influence canopy closure under the conditions of this trial, with crop growth likely more influenced by environmental conditions and overall field variability.

Table 7. Canopy Closure (Canopeo) results for “Potassium chloride replacements for chlorine uptake in canola” in Scott, SK in 2025.

Trt No.	Product	Rate (Actual lbs K_2O/ac)	Canopy Closure (Canopeo)	
1	Untreated Check	0	9.64	A
2	KCl (0-0-60)	13	10.08	A
3	KCl (0-0-60)	26	7.70	A
4	Pegasus	13	7.73	A
5	Pegasus	26	9.52	A
6	K-Mag Premium	13	10.89	A
7	K-Mag Premium	26	9.31	A
8	Aspire	13	8.77	A
9	Aspire	26	11.20	A
p-value			0.7542	

Indian Head

Canopy closure did not differ significantly among potassium treatments at Indian Head ($p = 0.0657$), although there was a slight trend toward treatment effects. Canopy closure values ranged from 25.54 to 32.39, with all treatments classified within the same statistical group (“A”). Numerically, K-Mag Premium at 13 lbs K_2O/ac (32.39) and Aspire at 26 lbs K_2O/ac (30.64) produced the highest canopy closure values, while Aspire at 13 lbs K_2O/ac (25.54) and KCl at 13 lbs K_2O/ac (26.26) were the lowest. Overall, the results suggest that potassium source and rate did

not significantly influence canopy closure at this site, though some products showed slightly greater canopy development, indicating a possible trend toward improved canopy growth with certain potassium sources.

Table 8. Canopy Closure (Canopeo) results for “Potassium chloride replacements for chlorine uptake in canola” in Indian Head, SK in 2025.

Trt No.	Product	Rate (Actual lbs K ₂ O/ac)	Canopy Closure (Canopeo)	
1	Untreated Check	0	30.26	A
2	KCl (0-0-60)	13	26.26	A
3	KCl (0-0-60)	26	28.15	A
4	Pegasus	13	30.35	A
5	Pegasus	26	29.01	A
6	K-Mag Premium	13	32.39	A
7	K-Mag Premium	26	27.83	A
8	Aspire	13	25.54	A
9	Aspire	26	30.64	A
p-value			0.0657	

Swift Current

Canopy closure did not differ significantly among potassium treatments at Swift Current ($p = 0.1018$), indicating that potassium source and application rate did not have a statistically significant effect on canopy development at this site. Canopy closure values ranged from 37.11 to 49.16, with all treatments falling within the same statistical group (“A”). Numerically, the untreated check (49.16) had the highest canopy closure, followed by Aspire at 13 lbs K₂O/ac (46.77) and K-Mag Premium at 26 lbs K₂O/ac (46.61). Lower canopy closure values were observed with KCl treatments and Pegasus treatments, which ranged from approximately 37–38. Overall, the results suggest that potassium fertilization did not significantly influence canopy closure under the conditions of this trial, and variation in canopy development was likely driven more by site conditions and natural field variability than by potassium source or rate.

Table 9. Canopy Closure (Canopeo) results for “Potassium chloride replacements for chlorine uptake in canola” in Swift Current, SK in 2025.

Trt No.	Product	Rate (Actual lbs K ₂ O/ac)	Canopy Closure (Canopeo)	
1	Untreated Check	0	49.16	A
2	KCl (0-0-60)	13	37.11	A
3	KCl (0-0-60)	26	37.56	A
4	Pegasus	13	37.70	A
5	Pegasus	26	38.25	A
6	K-Mag Premium	13	44.76	A
7	K-Mag Premium	26	46.61	A
8	Aspire	13	46.77	A
9	Aspire	26	38.55	A
p-value			0.1018	

Outlook

Canopy closure differed significantly among potassium treatments at Outlook ($p = 0.0047$), indicating that potassium source and rate influenced canopy development at this site. The highest canopy closure was observed with KCl at 26 lbs K₂O/ac (60.26), which ranked in the “A” group and was significantly greater than several other treatments. The lowest canopy closure values were recorded with KCl at 13 lbs K₂O/ac (32.93) and Pegasus at 26 lbs K₂O/ac (28.94), both classified in the “B” group. Most other treatments, including the untreated check and all remaining potassium products and rates, fell within the “AB” group, indicating intermediate canopy closure that was not statistically different from either the highest or lowest treatments. Overall, these results suggest that treatment responses varied considerably at this location, with KCl at the higher rate showing the strongest canopy development, while lower rates of some products resulted in reduced canopy closure.

Table 10. Canopy Closure (Canopeo) results for “Potassium chloride replacements for chlorine uptake in canola” in Outlook, SK in 2025.

Trt No.	Product	Rate (Actual lbs K ₂ O/ac)	Canopy Closure (Canopeo)	
1	Untreated Check	0	44.03	AB
2	KCl ⁻ (0-0-60)	13	32.93	B
3	KCl ⁻ (0-0-60)	26	60.26	A
4	Pegasus	13	49.51	AB
5	Pegasus	26	28.94	B
6	K-Mag Premium	13	41.66	AB
7	K-Mag Premium	26	40.42	AB
8	Aspire	13	40.20	AB
9	Aspire	26	49.36	AB
p-value			0.0047	

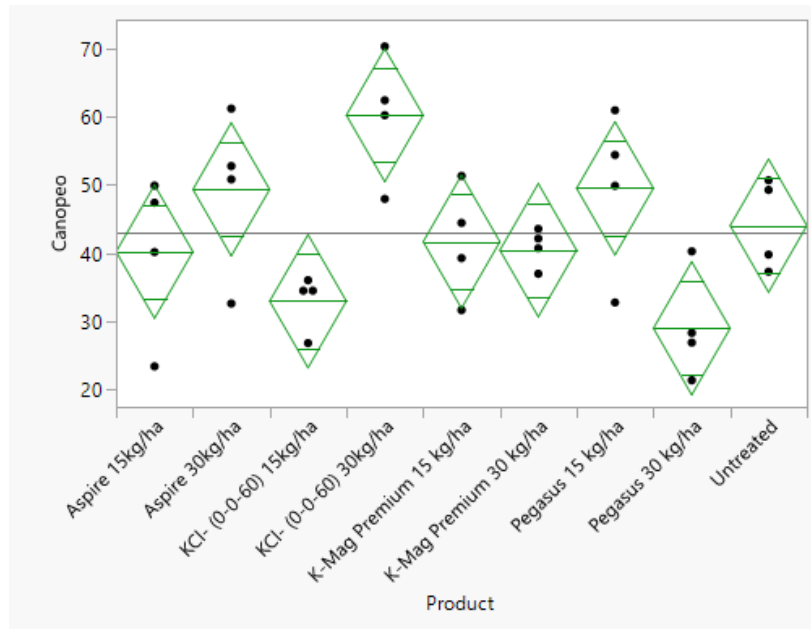


Figure 3. Canopy Closure (Canopeo) results for “Potassium chloride replacements for chlorine uptake in canola” in Outlook, SK in 2025.

Combined Results

When data from all sites were combined, canopy closure did not differ significantly among potassium treatments ($p = 0.509$), indicating that potassium source and application rate had no consistent effect on canopy development across environments. Canopy closure values ranged from 22.57 to 29.56, with all treatments falling within the same statistical group (“A”). Numerically,

KCl at 26 lbs K₂O/ac (29.56) and Aspire at 26 lbs K₂O/ac (28.58) showed the highest canopy closure values, while KCl at 13 lbs K₂O/ac (22.73) and Pegasus at 26 lbs K₂O/ac (22.57) were the lowest. Overall, the combined results suggest that potassium fertilization did not consistently influence canopy closure, and differences observed across individual sites were likely driven by local environmental conditions and field variability rather than potassium source or rate.

Table 11. Canopy Closure (Canopeo) results for “Potassium chloride replacements for chlorine uptake in canola” in Scott, Indian Head, Swift Current, and Outlook, SK in 2025.

Trt No.	Product	Rate (Actual lbs K ₂ O/ac)	Canopy Closure (Canopeo)	
1	Untreated Check	0	29.41	A
2	KCl (0-0-60)	13	22.73	A
3	KCl (0-0-60)	26	29.56	A
4	Pegasus	13	27.46	A
5	Pegasus	26	22.57	A
6	K-Mag Premium	13	28.56	A
7	K-Mag Premium	26	27.18	A
8	Aspire	13	26.46	A
9	Aspire	26	28.58	A
p-value			0.509	

Tissue Testing

Scott

At the Scott site, chloride (Cl) and potassium (K) concentrations did not differ significantly among treatments ($p = 0.9004$ for Cl and $p = 0.6672$ for K), indicating that potassium source and application rate had no measurable effect on tissue Cl or K levels in this trial. Chloride concentrations ranged from 0.27 to 0.45%, while potassium concentrations ranged from 4.69 to 5.23%, with all treatments falling within the same statistical grouping (“A”). Numerically, Aspire at 26 lbs K₂O/ac produced the highest K concentration (5.23%), while KCl at 26 lbs K₂O/ac had the lowest (4.69%), though these differences were not statistically significant. Overall, the results suggest that plant tissue nutrient levels were relatively consistent across treatments, and potassium fertilization did not significantly alter Cl or K uptake at this site.

Table 12. Tissue testing (Cl% and K%) results for “Potassium chloride replacements for chlorine uptake in canola” in Scott, SK in 2025.

Trt No.	Product	Rate (Actual lbs K ₂ O/ac)	Cl %		K %	
1	Untreated Check	0	0.45	A	4.76	A
2	KCl (0-0-60)	13	0.27	A	4.89	A
3	KCl (0-0-60)	26	0.38	A	4.69	A
4	Pegasus	13	0.45	A	4.93	A
5	Pegasus	26	0.27	A	4.98	A
6	K-Mag Premium	13	0.35	A	4.91	A
7	K-Mag Premium	26	0.33	A	4.91	A
8	Aspire	13	0.29	A	4.91	A
9	Aspire	26	0.40	A	5.23	A
p-value			0.9004		0.6672	

Indian Head

At the Indian Head site, chloride (Cl) concentrations differed significantly among treatments ($p < 0.0001$), while potassium (K) concentrations did not differ significantly ($p = 0.4598$). Chloride levels increased with potassium treatments that supplied chloride, with Pegasus at 26 lbs K₂O/ac (1.37%) and KCl at 26 lbs K₂O/ac (1.25%) producing the highest Cl concentrations and ranking in the top statistical group. In contrast, the untreated check (0.64%) and K-Mag Premium at 13 lbs K₂O/ac (0.74%) had the lowest chloride levels. Overall, there was a clear trend of increasing plant chloride concentration with increasing potassium rate, particularly with chloride-containing fertilizers. However, tissue potassium concentrations remained relatively stable across treatments, ranging from 5.15 to 5.51%, indicating that potassium fertilization did not significantly alter plant K levels at this site.

Table 13. Tissue testing (Cl% and K%) results for “Potassium chloride replacements for chlorine uptake in canola” in Indian Head, SK in 2025.

Trt No.	Product	Rate (Actual lbs K ₂ O/ac)	Cl %		K %	
1	Untreated Check	0	0.64	E	5.15	A
2	KCl (0-0-60)	13	1.05	BC	5.50	A
3	KCl (0-0-60)	26	1.25	AB	5.26	A
4	Pegasus	13	0.92	CD	5.28	A
5	Pegasus	26	1.37	A	5.19	A
6	K-Mag Premium	13	0.74	DE	5.48	A
7	K-Mag Premium	26	0.83	CDE	5.51	A
8	Aspire	13	0.98	CD	5.31	A
9	Aspire	26	1.26	AB	5.27	A
p-value			<0.0001		0.4598	

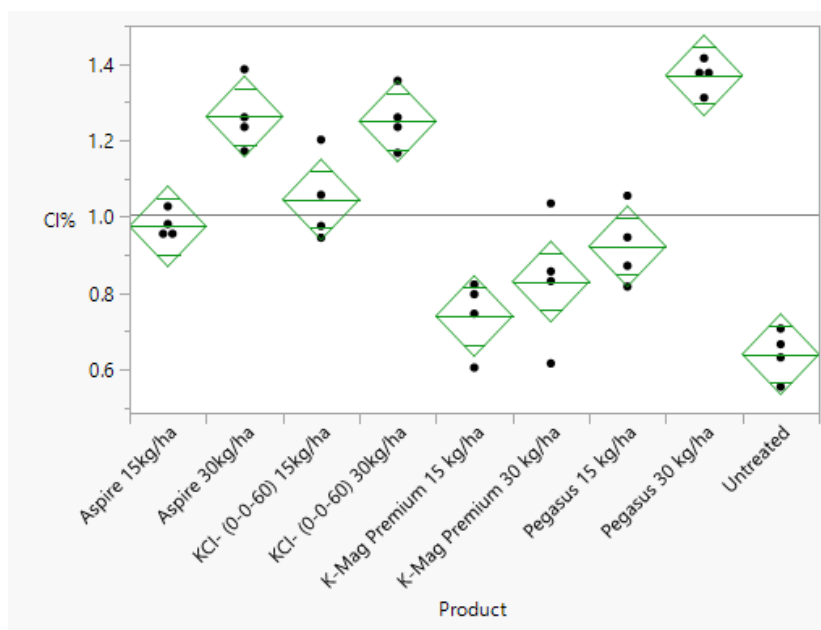


Figure 4. Tissue testing (Cl% and K%) results for “Potassium chloride replacements for chlorine uptake in canola” in Indian Head, SK in 2025.

Chloride (Cl) concentrations differed significantly among fertilizer sources ($p < 0.0001$). Treatments supplying chloride through KCl (0-0-60), Pegasus, and Aspire had significantly higher tissue Cl concentrations, averaging 1.12–1.15%, and were grouped in the “A” category. In contrast, the untreated check (0.64%) and K-Mag Premium (0.79%) had significantly lower chloride levels and were classified in the “B” group. These results indicate that fertilizer source strongly influenced plant chloride uptake, with chloride-containing potassium fertilizers increasing tissue Cl concentrations, while K-Mag Premium and the untreated treatment maintained lower chloride levels.

Table 14. Tissue testing (Cl% and K%) results focusing on Products (KCl- (0-0-60), Pegasus, K-Mag Premium, Aspire) for “Potassium chloride replacements for chlorine uptake in canola” in Indian Head, SK in 2025.

Product	Cl %	
Untreated	0.64	B
KCl- (0-0-60)	1.15	A
Pegasus	1.15	A
K-Mag Premium	0.79	B
Aspire	1.12	A
p-value	<0.0001	

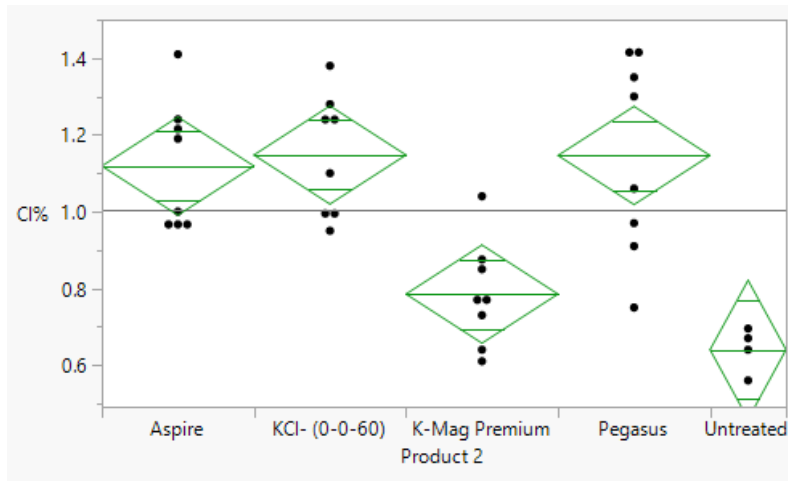


Figure 5. Tissue testing (Cl% and K%) results focusing on Products (KCl- (0-0-60), Pegasus, K-Mag Premium, Aspire) for “Potassium chloride replacements for chlorine uptake in canola” in Indian Head, SK in 2025.

Chloride (Cl) concentration increased significantly with increasing potassium application rate ($p < 0.0001$). The untreated check (0 lbs K_2O/ac) had the lowest chloride concentration (0.64%) and was classified in the “C” group. Applying 13 lbs K_2O/ac increased tissue chloride to 0.92% (group B), while the highest rate of 26 lbs K_2O/ac resulted in the greatest chloride concentration (1.18%) and ranked in the “A” group. These results indicate a clear positive relationship between potassium fertilizer rate and plant chloride concentration, with chloride levels increasing as potassium application rates increased.

Table 15. Tissue testing (Cl% and K%) results focusing on Rates (0,15,30 lbs K_2O) for “Potassium chloride replacements for chlorine uptake in canola” in Indian Head, SK in 2025.

Rate (Actual lbs K_2O/ac)	Cl %	
0	0.64	C
13	0.92	B
26	1.18	A
p-value	<0.0001	

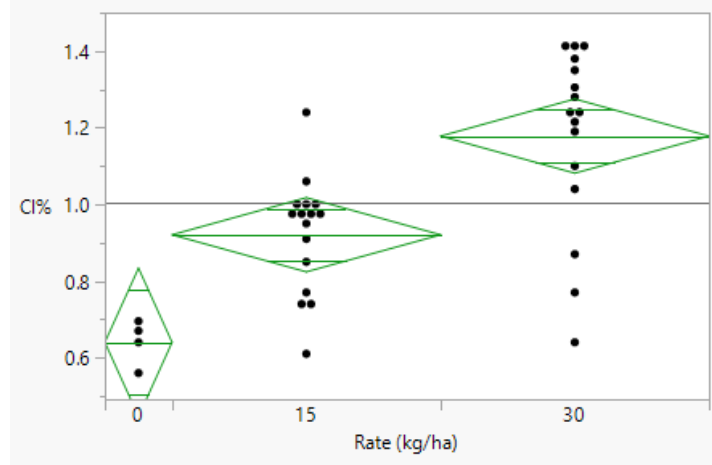


Figure 6. Tissue testing (Cl% and K%) results focusing on Rates (0,15,30 lbs K2O5) for “Potassium chloride replacements for chlorine uptake in canola” in Indian Head, SK in 2025.

Swift Current

At Swift Current, chloride (Cl) concentrations differed significantly among treatments ($p < 0.0001$), while potassium (K) concentrations did not differ significantly ($p = 0.602$). Chloride levels were lowest in the untreated check (0.21%) and both K-Mag Premium treatments (0.20%), which were grouped in the “B” category, indicating significantly lower Cl uptake. In contrast, Pegasus at both rates (0.83–1.00%), Aspire treatments (0.68–0.91%), and KCl at 26 lbs K_2O/ac (0.79%) produced the highest chloride concentrations and were classified in the “A” group, with KCl at 13 lbs K_2O/ac (0.64%) showing intermediate levels (AB). Overall, these results show a clear increase in plant chloride concentration with chloride-containing potassium fertilizers and higher application rates, while K-Mag Premium maintained low chloride levels similar to the untreated check. Despite these differences in Cl uptake, plant tissue potassium levels remained consistent across treatments, ranging from 3.06 to 3.48%.

Table 16. Tissue testing (Cl% and K%) results for “Potassium chloride replacements for chlorine uptake in canola” in Swift Current, SK in 2025.

Trt No.	Product	Rate (Actual lbs K ₂ O/ac)	Cl %		K %	
1	Untreated Check	0	0.21	B	3.18	A
2	KCl (0-0-60)	13	0.64	AB	3.41	A
3	KCl (0-0-60)	26	0.79	A	3.48	A
4	Pegasus	13	0.83	A	3.43	A
5	Pegasus	26	1.00	A	3.46	A
6	K-Mag Premium	13	0.20	B	3.06	A
7	K-Mag Premium	26	0.20	B	3.08	A
8	Aspire	13	0.68	A	3.20	A
9	Aspire	26	0.91	A	3.44	A
p-value			<0.0001		0.602	

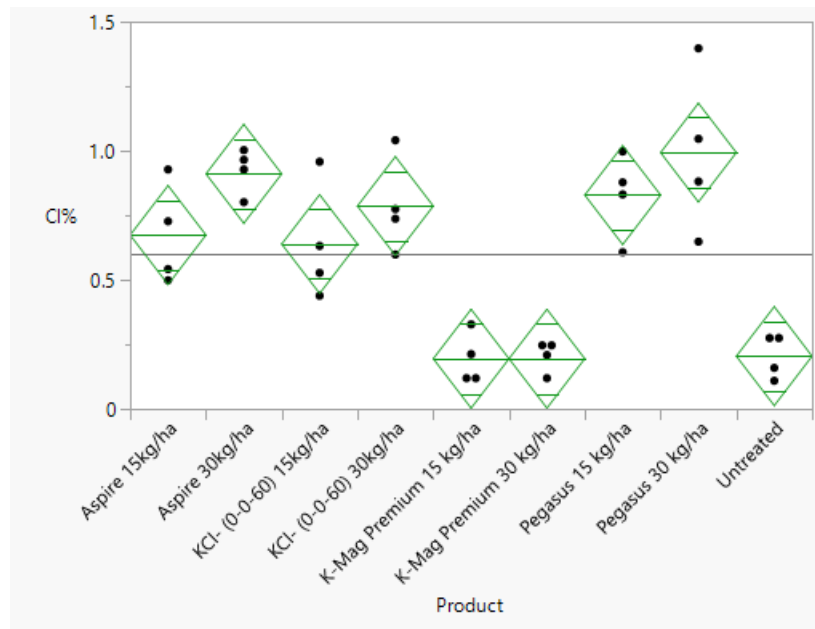


Figure 7. Tissue testing (Cl% and K%) results for “Potassium chloride replacements for chlorine uptake in canola” in Swift Current, SK in 2025.

Chloride (Cl) concentrations differed significantly among fertilizer sources ($p < 0.0001$). Treatments using KCl (0-0-60), Pegasus, and Aspire resulted in significantly higher tissue Cl concentrations, averaging 1.12–1.15%, and were grouped in the “A” category. In contrast, the untreated check (0.64%) and K-Mag Premium (0.79%) had significantly lower chloride concentrations and were classified in the “B” group. These results indicate that chloride-containing

potassium fertilizers increased plant chloride uptake, while K-Mag Premium maintained lower chloride levels similar to the untreated treatment.

Table 17. Tissue testing (Cl% and K%) results focusing on Products (KCl- (0-0-60), Pegasus, K-Mag Premium, Aspire) for “Potassium chloride replacements for chlorine uptake in canola” in Indian Head, SK in 2025.

Product	Cl %	
Untreated	0.21	B
KCl- (0-0-60)	0.71	A
Pegasus	0.91	A
K-Mag Premium	0.20	B
Aspire	0.79	A
p-value	<0.0001	

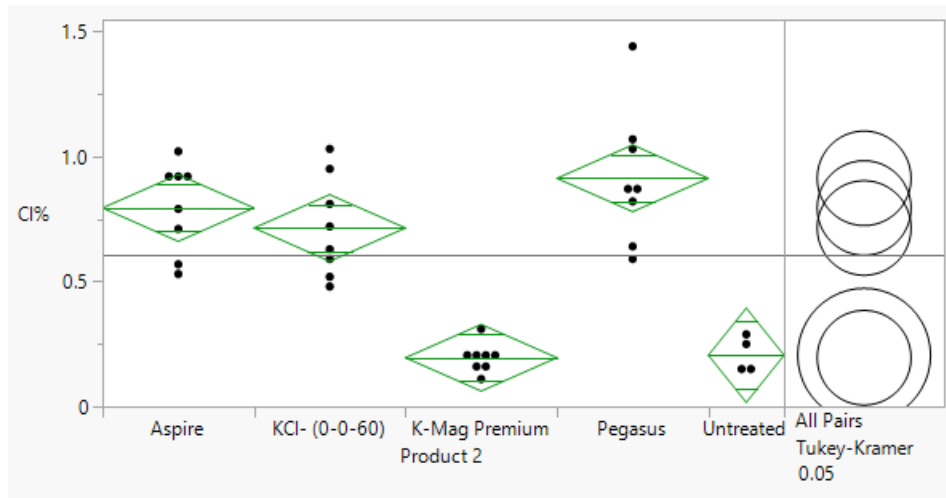


Figure 8. Tissue testing (Cl% and K%) results focusing on Products (KCl- (0-0-60), Pegasus, K-Mag Premium, Aspire) for “Potassium chloride replacements for chlorine uptake in canola” in Swift Current, SK in 2025.

Chloride (Cl) concentration increased significantly with increasing potassium application rate ($p < 0.0001$). The untreated check (0 lbs K_2O/ac) had the lowest chloride concentration (0.64%) and was classified in the “C” group. Applying 13 lbs K_2O/ac increased tissue chloride levels to 0.92% (group B), while the highest rate of 26 lbs K_2O/ac resulted in the greatest chloride concentration (1.18%) and ranked in the “A” group. These results demonstrate a clear positive

relationship between potassium application rate and plant chloride concentration, with higher fertilizer rates leading to increased chloride uptake.

Table 18. Tissue testing (Cl% and K%) results focusing on Rates (0,15,30 lbs K2O5) for “Potassium chloride replacements for chlorine uptake in canola” in Indian Head, SK in 2025.

Rate (Actual lbs K ₂ O/ac)	Cl %	
0	0.21	B
13	0.59	AB
26	0.72	A
p-value	0.0216	

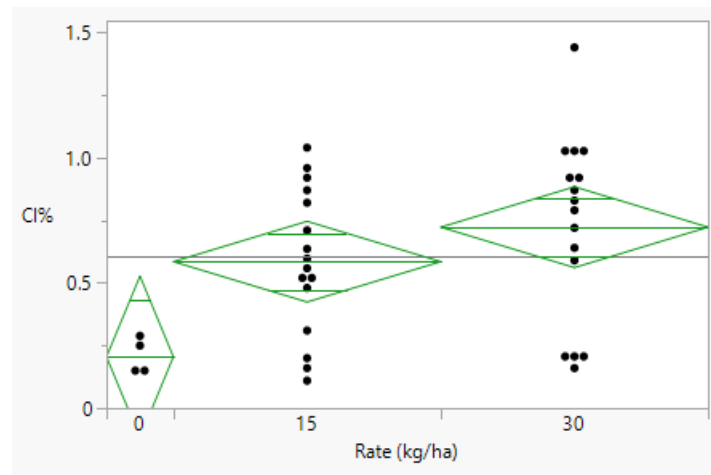


Figure 9. Tissue testing (Cl% and K%) results focusing on Rates (0,15,30 lbs K2O5) for “Potassium chloride replacements for chlorine uptake in canola” in Swift Current, SK in 2025.

Outlook

At the Outlook site, chloride (Cl) and potassium (K) concentrations did not differ significantly among treatments ($p = 0.0671$ for Cl and $p = 0.5224$ for K). Chloride concentrations ranged from 0.68 to 0.92%, with all treatments grouped within the same statistical category (“A”), indicating no significant treatment effect. Numerically, Aspire at 26 lbs K₂O/ac (0.92%) and the untreated check (0.85%) showed the highest Cl levels, while K-Mag Premium at 13 lbs K₂O/ac (0.68%) and Pegasus at 26 lbs K₂O/ac (0.69%) were among the lowest. Potassium concentrations were also relatively consistent across treatments, ranging from 3.23 to 3.73%, with K-Mag Premium at 26 lbs K₂O/ac showing the highest numerical K value. Overall, the results indicate that potassium

source and rate did not significantly influence plant tissue Cl or K concentrations at this site, and observed differences were likely due to normal field variability.

Table 19. Tissue testing (Cl% and K%) results for “Potassium chloride replacements for chlorine uptake in canola” in Outlook, SK in 2025.

Trt No.	Product	Rate (Actual lbs K ₂ O/ac)	Cl %		K %	
			Mean	Significance	Mean	Significance
1	Untreated Check	0	0.85	A	3.54	A
2	KCl (0-0-60)	13	0.87	A	3.39	A
3	KCl (0-0-60)	26	0.80	A	3.35	A
4	Pegasus	13	0.77	A	3.27	A
5	Pegasus	26	0.69	A	3.39	A
6	K-Mag Premium	13	0.68	A	3.23	A
7	K-Mag Premium	26	0.86	A	3.73	A
8	Aspire	13	0.85	A	3.38	A
9	Aspire	26	0.92	A	3.66	A
p-value			0.0671		0.5224	

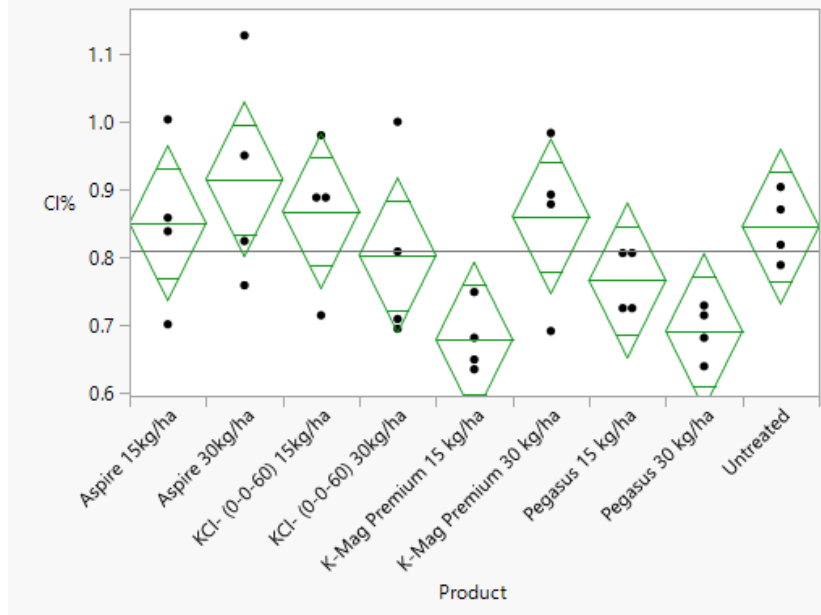


Figure 10. Tissue testing (Cl% and K%) results for “Potassium chloride replacements for chlorine uptake in canola” in Outlook, SK in 2025.

Combined Results

When results from all sites were combined, chloride (Cl) and potassium (K) concentrations did not differ significantly among treatments (p = 0.0666 for Cl and p = 0.4768 for K). Chloride

concentrations ranged from 0.49 to 0.87%, with all treatments grouped within the same statistical category (“A”). Numerically, Aspire at 26 lbs K₂O/ac (0.87%) and Pegasus at 26 lbs K₂O/ac (0.83%) showed the highest Cl levels, while K-Mag Premium at 13 lbs K₂O/ac (0.49%) and the untreated check (0.54%) were among the lowest. Potassium concentrations were also consistent across treatments, ranging from 4.07 to 4.32%, with Aspire at 26 lbs K₂O/ac producing the highest numerical K concentration. Overall, the combined results suggest that potassium source and application rate did not consistently influence plant tissue Cl or K concentrations across environments, and most variation observed among treatments was likely due to site-specific conditions and natural field variability.

Table 20. Tissue testing (Cl% and K%) results for “Potassium chloride replacements for chlorine uptake in canola” in Scott, Indian Head, Swift Current and Outlook, SK in 2025.

Trt No.	Product	Rate (Actual lbs K ₂ O/ac)	Cl %		K %	
1	Untreated Check	0	0.54	A	4.07	A
2	KCl (0-0-60)	13	0.71	A	4.21	A
3	KCl (0-0-60)	26	0.81	A	4.11	A
4	Pegasus	13	0.74	A	4.14	A
5	Pegasus	26	0.83	A	4.17	A
6	K-Mag Premium	13	0.49	A	4.09	A
7	K-Mag Premium	26	0.56	A	4.22	A
8	Aspire	13	0.70	A	4.12	A
9	Aspire	26	0.87	A	4.32	A
p-value			0.0666		0.4768	

Chloride (Cl) concentrations differed significantly among fertilizer sources when data were combined across sites ($p = 0.0031$). Treatments using KCl (0-0-60), Pegasus, and Aspire resulted in the highest tissue Cl concentrations, ranging from 0.76–0.79%, and were grouped in the “A” category. In contrast, K-Mag Premium (0.52%) had the lowest chloride concentration and was classified in the “B” group, indicating significantly lower Cl uptake. The untreated check (0.54%) was intermediate (AB) and did not differ statistically from either group. Overall, these results suggest that chloride-containing potassium fertilizers increased plant chloride concentrations, while K-Mag Premium maintained lower tissue chloride levels similar to the untreated treatment.

Table 21. Tissue testing (Cl% and K%) results focusing on Products (KCl- (0-0-60), Pegasus, K-Mag Premium, Aspire) for “Potassium chloride replacements for chlorine uptake in canola” in Scott, Indian Head, Swift Current and Outlook, SK in 2025.

Product	Cl %	
Untreated	0.54	AB
KCl- (0-0-60)	0.76	A
Pegasus	0.79	A
K-Mag Premium	0.52	B
Aspire	0.78	A
p-value	0.0031	

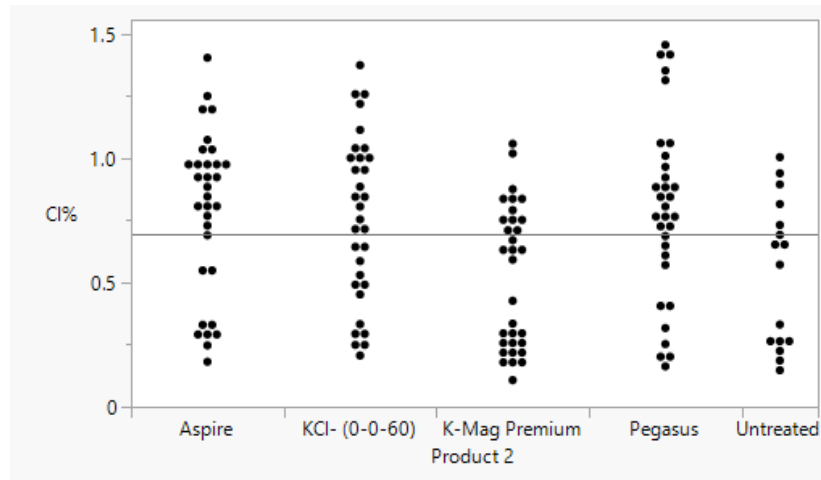


Figure 11. Tissue testing (Cl% and K%) results focusing on Products (KCl- (0-0-60), Pegasus, K-Mag Premium, Aspire) for “Potassium chloride replacements for chlorine uptake in canola” in Scott, Indian Head, Swift Current and Outlook, SK in 2025.

Chloride (Cl) concentration increased significantly with increasing potassium application rate when data were combined across sites ($p = 0.0329$). The untreated check (0 lbs K_2O/ac) had the lowest chloride concentration (0.54%) and was classified in the “B” group. Applying 13 lbs K_2O/ac resulted in an intermediate Cl concentration (0.66%, group AB), which was not significantly different from either the untreated check or the higher rate. The 26 lbs K_2O/ac rate produced the highest chloride concentration (0.76%) and ranked in the “A” group. Overall, these results indicate a trend of increasing plant chloride concentration with higher potassium application rates, suggesting greater chloride uptake as fertilizer rates increased.

Table 22. Tissue testing (Cl% and K%) results focusing on Rates (0,15,30 lbs K2O5) for “Potassium chloride replacements for chlorine uptake in canola” in Scott, Indian Head, Swift Current and Outlook, SK in 2025.

Rate (Actual lbs K ₂ O/ac)	Cl %	
0	0.54	B
13	0.66	AB
26	0.76	A
p-value	0.0329	

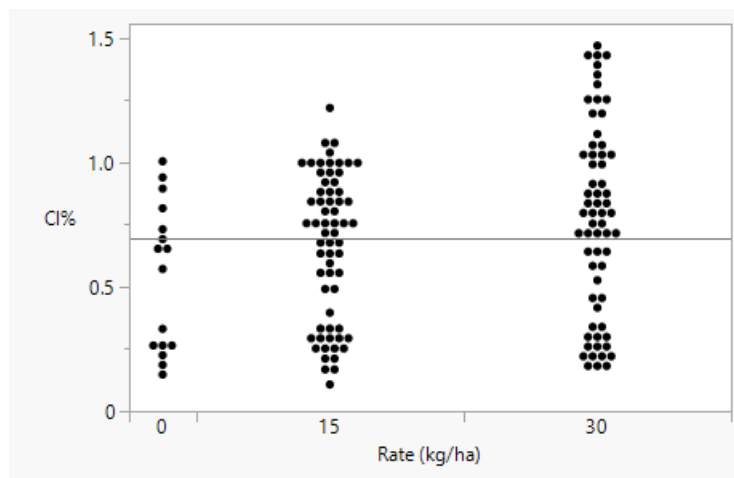


Figure 12. Tissue testing (Cl% and K%) results focusing on Rates (0,15,30 lbs K2O5) for “Potassium chloride replacements for chlorine uptake in canola” in Scott, Indian Head, Swift Current and Outlook, SK in 2025.

Yield

Scott

At the Scott site, yield did not differ significantly among potassium treatments ($p = 0.8974$), indicating that potassium source and application rate had no measurable effect on grain yield under the conditions of this trial. Yields ranged from 3241 to 3446 kg/ha, with all treatments grouped within the same statistical category (“A”). Numerically, K-Mag Premium at 13 lbs K₂O/ac (3445.9 kg/ha) produced the highest yield, while Aspire at 13 lbs K₂O/ac (3241.4 kg/ha) and KCl at 26 lbs K₂O/ac (3246.7 kg/ha) were among the lowest. Overall, the results suggest that potassium fertilization did not improve yield at this location, and the relatively similar yields across

treatments indicate that soil potassium levels or growing conditions were likely sufficient to meet crop demand.

Table 23. Yield (kg/ha) results for “Potassium chloride replacements for chlorine uptake in canola” in Scott, SK in 2025.

Trt No.	Product	Rate (Actual lbs K ₂ O/ac)	Yield (kg/ha)	
1	Untreated Check	0	3382.3	A
2	KCl (0-0-60)	13	3320.8	A
3	KCl (0-0-60)	26	3246.7	A
4	Pegasus	13	3335.7	A
5	Pegasus	26	3258.3	A
6	K-Mag Premium	13	3445.9	A
7	K-Mag Premium	26	3339.9	A
8	Aspire	13	3241.4	A
9	Aspire	26	3342.0	A
p-value			0.8974	

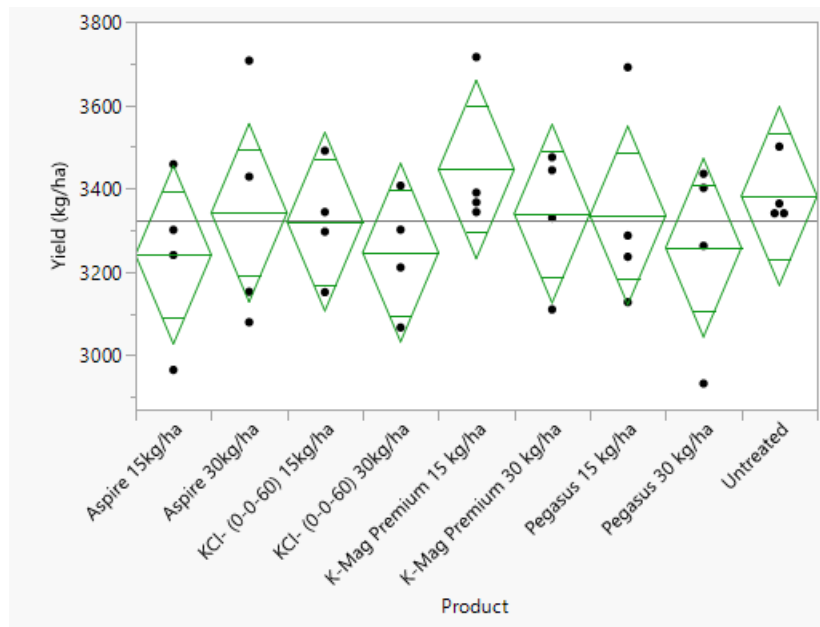


Figure 13. Yield (kg/ha) results for “Potassium chloride replacements for chlorine uptake in canola” in Scott, SK in 2025.

Indian Head

At the Indian Head site, yield did not differ significantly among potassium treatments ($p = 0.2929$), indicating that potassium source and application rate had no statistically significant effect on grain yield. Yields ranged from 2991.9 to 3187.6 kg/ha, with all treatments falling within the same statistical group (“A”). Numerically, K-Mag Premium at 26 lbs K_2O/ac (3187.6 kg/ha) and K-Mag Premium at 13 lbs K_2O/ac (3156.8 kg/ha) produced the highest yields, while KCl at 13 lbs K_2O/ac (2991.9 kg/ha) and the untreated check (3012.6 kg/ha) were among the lowest. Overall, the results suggest that potassium fertilization did not significantly increase yield at this site, although some potassium sources and higher rates showed a slight numerical trend toward higher yields.

Table 24. Yield (kg/ha) results for “Potassium chloride replacements for chlorine uptake in canola” in Indian Head, SK in 2025.

Trt No.	Product	Rate (Actual lbs K_2O/ac)	Yield (kg/ha)	
1	Untreated Check	0	3012.6	A
2	KCl (0-0-60)	13	2991.9	A
3	KCl (0-0-60)	26	3109.1	A
4	Pegasus	13	3131.7	A
5	Pegasus	26	3141.6	A
6	K-Mag Premium	13	3156.8	A
7	K-Mag Premium	26	3187.6	A
8	Aspire	13	3086.2	A
9	Aspire	26	3033.7	A
p-value			0.2929	

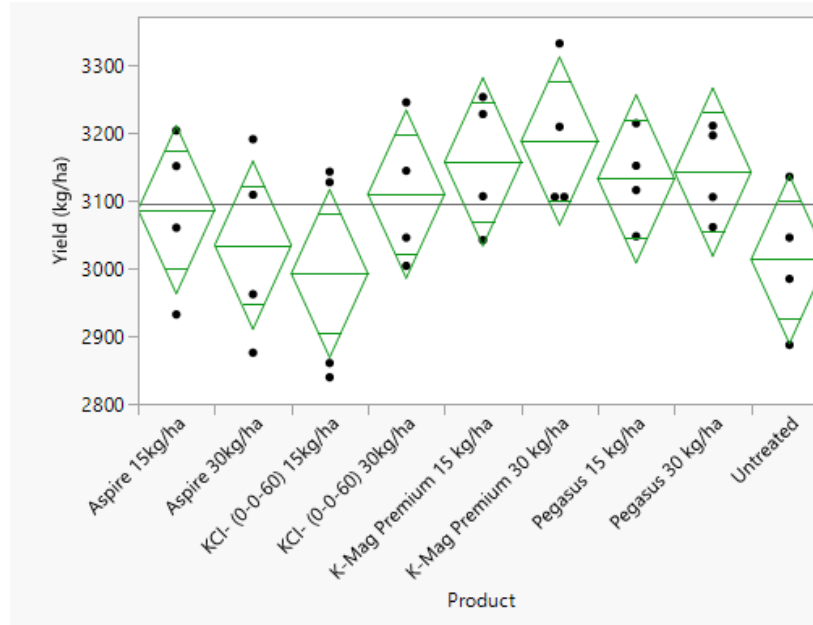


Figure 14. Yield (kg/ha) results for “Potassium chloride replacements for chlorine uptake in canola” in Indian Head, SK in 2025.

Swift Current

At the Swift Current site, yield did not differ significantly among potassium treatments ($p = 0.1361$), indicating that potassium source and application rate had no statistically significant effect on grain yield under the conditions of this trial. Yields ranged from 2008.2 to 2353.4 kg/ha, with all treatments classified within the same statistical group (“A”). Numerically, KCl at 13 lbs K_2O/ac (2353.4 kg/ha) produced the highest yield, followed by KCl at 26 lbs K_2O/ac (2292.0 kg/ha) and K-Mag Premium at 13 lbs K_2O/ac (2265.6 kg/ha). The lowest yield was observed with Pegasus at 13 lbs K_2O/ac (2008.2 kg/ha). Overall, the results suggest that potassium fertilization did not significantly impact yield at this site, although some treatments showed slight numerical differences that were likely due to normal field variability.

Outlook

At the Outlook site, yield did not differ significantly among potassium treatments ($p = 0.2405$), indicating that potassium source and application rate had no statistically significant effect on grain yield. Yields ranged from 2768.3 to 3425.5 kg/ha, with all treatments classified within the same statistical group (“A”). Numerically, Aspire at 26 lbs K_2O/ac (3425.5 kg/ha) and Aspire at 13 lbs K_2O/ac (3225.9 kg/ha) produced the highest yields, while the untreated check (2768.3 kg/ha) was the lowest. Other potassium sources, including KCl, Pegasus, and K-Mag Premium, produced intermediate yields between 2864 and 3139 kg/ha. Overall, the results suggest that potassium fertilization did not significantly impact yield at this location, although some treatments, particularly Aspire, showed a numerical trend toward higher yields.

Table 26. Yield (kg/ha) results for “Potassium chloride replacements for chlorine uptake in canola” in Outlook, SK in 2025.

Trt No.	Product	Rate (Actual lbs K_2O/ac)	Yield (kg/ha)	
1	Untreated Check	0	2768.3	A
2	KCl (0-0-60)	13	2864.0	A
3	KCl (0-0-60)	26	3138.7	A
4	Pegasus	13	3069.0	A
5	Pegasus	26	3011.7	A
6	K-Mag Premium	13	3044.6	A
7	K-Mag Premium	26	2999.7	A
8	Aspire	13	3225.9	A
9	Aspire	26	3425.5	A
p-value			0.2405	

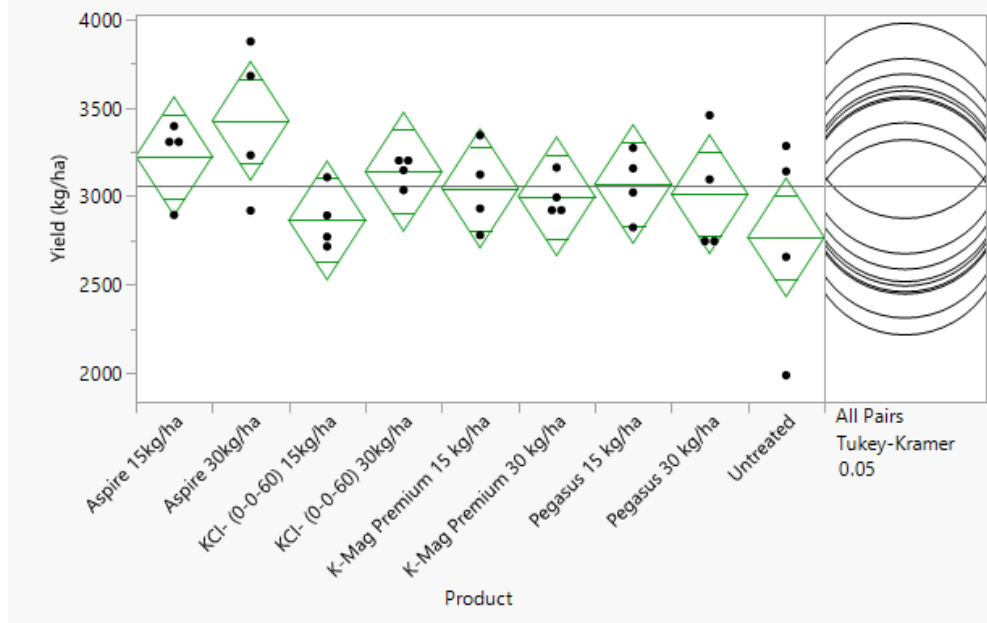


Figure 16. Yield (kg/ha) results for “Potassium chloride replacements for chlorine uptake in canola” in Outlook, SK in 2025.

Yield differed among fertilizer sources, with Aspire producing the highest average yield (3325.7 kg/ha) and ranking in the “A” group, indicating it was significantly greater than the untreated check (2768.3 kg/ha), which was classified in the “B” group. The other potassium sources, including KCl (3001.4 kg/ha), Pegasus (3040.3 kg/ha), and K-Mag Premium (3022.1 kg/ha), produced intermediate yields and were grouped as “AB”, meaning they were not significantly different from either Aspire or the untreated treatment. Overall, these results suggest a trend toward improved yield with potassium fertilization, with Aspire showing the strongest yield response, while the other potassium sources produced moderate but statistically similar yields.

Table 27. Yield (kg/ha) results focusing on Products (KCl- (0-0-60), Pegasus, K-Mag Premium, Aspire) for “Potassium chloride replacements for chlorine uptake in canola” in Outlook, SK in 2025.

Product	Yield (kg/ha)	Group
Untreated	2768.3	B
KCl- (0-0-60)	3001.4	AB
Pegasus	3040.3	AB
K-Mag Premium	3022.1	AB
Aspire	3325.7	A
p-value	.0521	

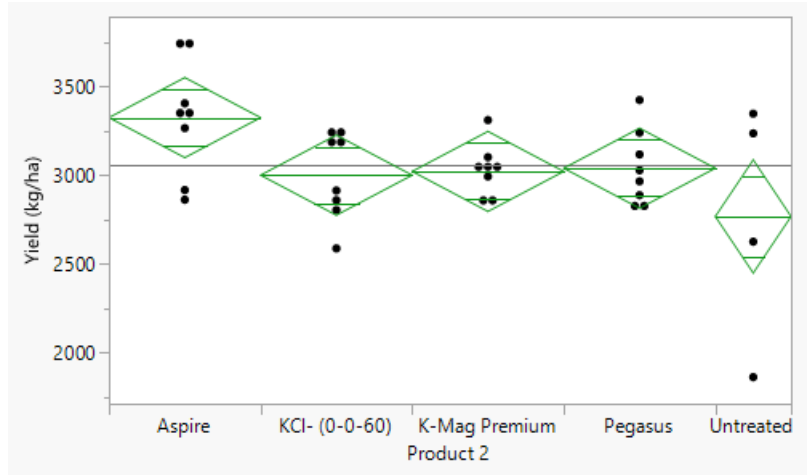


Figure 17. Yield (kg/ha) results focusing on Products (KCl- (0-0-60), Pegasus, K-Mag Premium, Aspire) for “Potassium chloride replacements for chlorine uptake in canola” in Outlook, SK in 2025.

Combined Results

When results were combined across treatments, yield did not differ significantly among potassium sources or application rates ($p = 0.7878$). Grain yield ranged from 2836 to 2978 kg/ha (50.5–53.0 bu/ac), with all treatments falling within the same statistical group (“A”). Numerically, K-Mag Premium at 13 lbs K_2O/ac (2977.6 kg/ha; 53.0 bu/ac) and Aspire at 26 lbs K_2O/ac (2973.7 kg/ha; 52.9 bu/ac) produced the highest yields, while the untreated check (2836.5 kg/ha; 50.5 bu/ac) was the lowest. Overall, these results indicate that potassium fertilization did not significantly influence yield under the conditions of this trial, although several potassium treatments showed slight numerical increases compared to the untreated check.

Table 28. Yield (kg/ha) results for “Potassium chloride replacements for chlorine uptake in canola” in Outlook, SK in 2025.

Trt No.	Product	Rate (Actual lbs K ₂ O/ac)	Yield (kg/ha)		Yield (bu/ac)	
1	Untreated Check	0	2836.48	A	50.5	A
2	KCl (0-0-60)	13	2881.91	A	51.3	A
3	KCl (0-0-60)	26	2945.98	A	52.4	A
4	Pegasus	13	2885.51	A	51.4	A
5	Pegasus	26	2880.89	A	51.3	A
6	K-Mag Premium	13	2977.59	A	53.0	A
7	K-Mag Premium	26	2930.24	A	52.2	A
8	Aspire	13	2943.01	A	52.4	A
9	Aspire	26	2973.66	A	52.9	A
p-value			0.7878			

Grain Analysis

Scott

At the Scott site, protein, oil content, and test weight did not differ significantly among potassium treatments ($p = 0.1137$ for protein, $p = 0.5267$ for oil, and $p = 0.3554$ for test weight). Protein concentrations ranged from 19.2 to 20.4%, oil content from 46.7 to 50.8%, and test weight from 63.7 to 64.0 kg/hL, with all treatments falling within the same statistical group (“A”). Numerically, KCl at 13 lbs K₂O/ac produced the highest protein concentration (20.4%), Aspire at 13 lbs K₂O/ac had the highest oil content (50.8%), and KCl and Pegasus at 26 lbs K₂O/ac had the highest test weight (64.0 kg/hL). Overall, the results indicate that potassium source and application rate did not significantly influence grain quality parameters at this site, and differences observed among treatments were likely due to normal field variability.

Table 29. Grain Analysis (Protein (%), Oil (%), Test Weight (TW)(kg/hL) results for “Potassium chloride replacements for chlorine uptake in canola” in Scott, SK in 2025.

Trt No.	Product	Rate (Actual lbs K ₂ O/ac)	Protein (%)		Oil (%)		Test Weight (TW) (kg/hL)	
1	Untreated Check	0	20.3	A	50.6	A	63.8	A
2	KCl (0-0-60)	13	20.4	A	50.3	A	63.8	A
3	KCl (0-0-60)	26	20.2	A	49.9	A	64.0	A
4	Pegasus	13	19.6	A	46.7	A	63.8	A
5	Pegasus	26	20.3	A	50.1	A	64.0	A
6	K-Mag Premium	13	20.0	A	49.7	A	63.8	A
7	K-Mag Premium	26	20.3	A	49.7	A	63.8	A
8	Aspire	13	19.2	A	50.8	A	63.7	A
9	Aspire	26	19.8	A	50.2	A	63.7	A
p-value			0.1137		0.5267		0.3554	

Indian Head

At the Indian Head site, protein, oil content, and test weight did not differ significantly among potassium treatments ($p = 0.427$ for protein, $p = 0.8023$ for oil, and $p = 0.4613$ for test weight). Protein levels ranged from 19.8 to 20.5%, oil content from 43.5 to 44.1%, and test weight from 67.7 to 67.9 kg/hL, with all treatments grouped within the same statistical category (“A”). Numerically, K-Mag Premium at 26 lbs K₂O/ac and Aspire at 26 lbs K₂O/ac produced the highest protein values (20.5%), while Pegasus and K-Mag Premium at 13–26 lbs K₂O/ac showed the highest oil content (44.1%). K-Mag Premium at 26 lbs K₂O/ac also produced the highest test weight (67.9 kg/hL). Overall, the results indicate that potassium source and application rate did not significantly affect grain quality parameters at this site, and the small numerical differences observed were likely due to normal field variability.

Table 30. Grain Analysis (Protein (%), Oil (%), Test Weight (TW)(kg/hL) results for “Potassium chloride replacements for chlorine uptake in canola” in Indian Head, SK in 2025.

Trt No.	Product	Rate (Actual lbs K ₂ O/ac)	Protein (%)		Oil (%)		Test Weight (TW) (kg/hL)	
1	Untreated Check	0	20.2	A	43.5	A	67.8	A
2	KCl (0-0-60)	13	19.9	A	43.9	A	67.7	A
3	KCl (0-0-60)	26	19.8	A	44.0	A	67.7	A
4	Pegasus	13	20.2	A	43.8	A	67.8	A
5	Pegasus	26	19.8	A	44.1	A	67.7	A
6	K-Mag Premium	13	19.8	A	44.1	A	67.7	A
7	K-Mag Premium	26	20.5	A	43.5	A	67.9	A
8	Aspire	13	20.3	A	43.6	A	67.8	A
9	Aspire	26	20.5	A	43.6	A	67.8	A
p-value			0.427		0.8023		0.4613	

Swift Current

At the Swift Current site, protein, oil content, and test weight did not differ significantly among potassium treatments ($p = 0.9124$ for protein, $p = 0.6929$ for oil, and $p = 0.3774$ for test weight). Protein concentrations ranged from 25.0 to 26.0%, oil content from 44.4 to 45.6%, and test weight from 68.0 to 68.3 kg/hL, with all treatments grouped within the same statistical category (“A”). Numerically, K-Mag Premium at 26 lbs K₂O/ac produced the highest protein concentration (26.0%), while Aspire at 13 lbs K₂O/ac had the highest oil content (45.6%). K-Mag Premium at 13 lbs K₂O/ac also showed the highest test weight (68.3 kg/hL). Overall, the results indicate that potassium source and application rate did not significantly influence grain quality parameters at this site, and the minor numerical differences observed were likely due to natural field variability.

Table 31. Grain Analysis (Protein (%), Oil (%), Test Weight (TW)(kg/hL) results for “Potassium chloride replacements for chlorine uptake in canola” in Swift Current, SK in 2025.

Trt No.	Product	Rate (Actual lbs K ₂ O/ac)	Protein (%)		Oil (%)		Test Weight (TW) (kg/hL)	
1	Untreated Check	0	25.2	A	45.4	A	68.0	A
2	KCl (0-0-60)	13	25.4	A	45.0	A	68.0	A
3	KCl (0-0-60)	26	25.3	A	44.8	A	68.2	A
4	Pegasus	13	25.7	A	44.6	A	68.1	A
5	Pegasus	26	25.8	A	44.7	A	68.1	A
6	K-Mag Premium	13	25.8	A	45.0	A	68.3	A
7	K-Mag Premium	26	26.0	A	44.6	A	68.2	A
8	Aspire	13	25.0	A	45.6	A	68.0	A
9	Aspire	26	25.3	A	44.4	A	68.2	A
p-value			0.9124		0.6929		0.3774	

Outlook

At the Outlook site, oil content and test weight did not differ significantly among potassium treatments ($p = 0.3877$ for oil and $p = 0.7736$ for test weight). Oil concentrations ranged from 38.8 to 43.2%, while test weight varied from 66.5 to 67.6 kg/hL, with all treatments classified within the same statistical group (“A”). Numerically, the untreated check and KCl at 13 lbs K₂O/ac produced the highest oil content (43.2%), while K-Mag Premium at 26 lbs K₂O/ac had the lowest (38.8%). The highest test weight was observed with K-Mag Premium at 13 lbs K₂O/ac (67.6 kg/hL). Overall, the results indicate that potassium source and application rate did not significantly influence oil content or test weight at this site. Protein analysis was not completed for this location, so no conclusions could be drawn for that parameter.

Table 32. Grain Analysis (Oil (%), Test Weight (TW)(kg/hL) results for “Potassium chloride replacements for chlorine uptake in canola” in Outlook, SK in 2025.

Trt No.	Product	Rate (Actual lbs K ₂ O/ac)	Oil (%)		Test Weight (TW) (kg/hL)	
1	Untreated Check	0	43.2	A	66.8	A
2	KCl (0-0-60)	13	43.2	A	67.2	A
3	KCl (0-0-60)	26	42.8	A	67.0	A
4	Pegasus	13	41.9	A	67.1	A
5	Pegasus	26	42.7	A	67.1	A
6	K-Mag Premium	13	42.5	A	67.6	A
7	K-Mag Premium	26	38.8	A	66.6	A
8	Aspire	13	42.7	A	66.9	A
9	Aspire	26	42.3	A	66.5	A
p-value			0.3877		0.7736	

Combined Results

When results were combined across all sites, protein, oil content, and test weight did not differ significantly among potassium treatments ($p = 0.5234$ for protein, $p = 0.1088$ for oil, and $p = 0.6891$ for test weight). Protein concentrations ranged from 21.1 to 21.8%, oil content from 44.2 to 45.7%, and test weight from 66.9 to 67.1 kg/hL, with all treatments grouped within the same statistical category (“A”). Numerically, K-Mag Premium at 26 lbs K₂O/ac produced the highest protein concentration (21.8%), while the untreated check and Aspire at 13 lbs K₂O/ac showed the highest oil content (45.7%). K-Mag Premium at 13 lbs K₂O/ac also had the highest test weight

(67.1 kg/hL). Overall, these results indicate that potassium source and application rate did not consistently influence grain quality parameters across environments, and the small numerical differences observed were likely due to site variability rather than treatment effects.

Table 33. Grain Analysis (Protein (%), Oil (%), Test Weight (TW)(kg/hL) results for “Potassium chloride replacements for chlorine uptake in canola” in Scott, Indian Head, Swift Current and Outlook, SK in 2025.

Trt No.	Product	Rate (Actual lbs K ₂ O/ac)	Protein (%)		Oil (%)		Test Weight (TW) (kg/hL)	
1	Untreated Check	0	21.5	A	45.7	A	66.9	A
2	KCl (0-0-60)	13	21.5	A	45.6	A	67.0	A
3	KCl (0-0-60)	26	21.3	A	45.4	A	67.0	A
4	Pegasus	13	21.4	A	44.3	A	67.0	A
5	Pegasus	26	21.5	A	45.4	A	67.0	A
6	K-Mag Premium	13	21.4	A	45.3	A	67.1	A
7	K-Mag Premium	26	21.8	A	44.2	A	66.9	A
8	Aspire	13	21.1	A	45.7	A	66.9	A
9	Aspire	26	21.4	A	45.2	A	66.9	A
p-value			0.5234		0.1088		0.6891	

4. Conclusions and Recommendations

Across four Saskatchewan sites in 2025, replacing standard KCl (0-0-60) with alternative potassium products (Pegasus, K-Mag Premium, and Aspire) produced limited and inconsistent agronomic responses in canola. While plant density differed at Scott and Swift Current, and canopy closure differed at Outlook, these effects were site-specific and did not persist when data were pooled across locations. In contrast, tissue chloride (Cl) concentration responded strongly and consistently to fertilizer source and rate, increasing with chloride-containing products and higher K₂O rates. When combined across sites, Cl-containing products (KCl, Pegasus, Aspire) resulted in significantly higher tissue Cl than K-Mag Premium, and increasing rate also increased tissue Cl. Despite these clear differences in Cl uptake, yield and grain quality (protein, oil, test weight) were not consistently affected by product or rate across sites. Overall, the study indicates that potassium chloride replacement products can alter plant chloride status, but in 2025 these changes did not translate into consistent improvements in yield or seed quality under the range of environments tested.

Recommendations from this study emphasize matching potassium products to the intended chloride (Cl) management goal rather than expecting consistent yield gains. Where the objective is to increase plant Cl uptake—such as fields suspected to be Cl-limited—chloride-containing sources like KCl, Pegasus, or Aspire were the most reliable options based on tissue responses, whereas when the objective is to reduce chloride loading (e.g., in areas with salinity risk or where lower Cl inputs are preferred), K-Mag Premium was a consistent choice and maintained comparatively lower tissue Cl levels. Because yield and canopy responses were inconsistent across locations, product selection should be guided by a site-specific approach that considers soil testing results, soil texture and zone, field history, nutrient removal, and existing Cl and K status, rather than applying a uniform strategy across all environments. Future research should focus on strengthening the link between Cl uptake and agronomic outcomes by targeting more Cl-deficient site-years and wider soil Cl gradients, evaluating timing and placement strategies (seed-placed, sideband, and in-season applications) for early-season vigor responses, adding physiological measurements such as NDVI/biomass, water use efficiency, and disease assessments, and continuing multi-site replication to better separate true treatment effects from environmental variability.

In practice, based on 2025 results, growers can justify KCl replacement products primarily for equipment handling considerations, chloride management goals, and nutrient package fit, while recognizing that consistent yield or quality gains are unlikely without confirmed site-specific nutrient limitations.

5. Acknowledgments

Acknowledgements go to the staff and technicians who assisted with field trial establishment, management, data collection, and harvest at the Scott, Indian Head, Swift Current, and Outlook locations. Funding for this project was provided by the Saskatchewan Oilseeds Development Commission through the Canola Agronomic Research Program (CARP), whose support of applied agronomic research is gratefully acknowledged.

6. Appendices

Appendix I: Crop Maintenance

Table #. Operations timeline for crop maintenance and data collection at Scott, Indian Head, Outlook and Swift Current I 2025 for “Potassium chloride replacements for chlorine uptake in canola”.

	Scott		Indian Head		Outlook		Swift Current	
Soil Sampling:	30-Apr-25		14-May-25		April 28, 2025		28-Apr-25	
Seeder:	Fabro Seeder, knife opener		Seed Master		-		Fabro Built Cone Seeder, Disk openers	
Row Spacing:	10"		12"		10"		8.25"	
Seeding Date:	May 15, 2025		May 24, 2025		02-Jun-25		08-May-25	
Seeding Rate:	110 seeds/m2		115 seeds/m2		110 seeds/m2		110 seeds/m2	
Seed Depth:	3/4"		7/8"		3/4"		3/4"	
Stubble Type:	Wheat		Canary Seed		Wheat		Durum	
Fertility	90 lbs N/ac, 26 lbs P2O5/ac, 15lbs S/ac	Urea, MAP, AMS	123 lbs N/ac, 35 lbs P2O5/ac, 26 lbs S/ac	Urea, MAP, AMS	48 lbs N/ac & 25 lbs P2O5/ac	Urea & MAP	110 lbs N/ac, 55 lbs P2O5/ac, 22 lbs S/ac	-
Pre-seed herbicide:	13-May	Glyphosate (1L/ac) & Aim (35 ml/ac)	24-May-25	Roundup Weathermax @ 0.67 L/ac	-	Glyphosate @ 1 L/ac + Aim @ 35 mL/ac	18-Apr-25	Roundup Transorb @ 1 L/ac + Aim @ 47 mL/ac + Merge @ 1 L/100L vol
Plant Density Counts:	11-Jun		17-Jun		19-Jun		12-Jun	

In-crop application 1:	17-Jun	Liberty 150 @ 1.62 L/ac, Centurion @ 75 mL/ac & Amigo 0.5 L/100 L	15-Jun-25	Liberty 150SN @ 1.35 L/ac + Centurion ADV @ 150 mL/ac + Valid @ 1.25%	20-Jun-25	Liberty 150 @ 1.62 L/ac, Centurion @ 75 mL/ac & Amigo 0.5 L/100 L	20-Jun-25	Liberty @ 1.62 L/ac
In-crop application 2:	-	-	27-Jun-25	Liberty 150SN @ 1.35 L/ac + Centurion ADV @ 150 mL/ac + Valid @ 1.25%	-	-	-	-
Canopy Closure:	20-Jun		27-Jun & 30-Jun		17-Jul		16-Jun	
Tissue Testing:	20-Jun		30-Jun		26-Jun		16-Jun	
Fungicide:	07-Jul	Cotegra @ 280mL/ac	16-Jul-25	Cotegra @ 280 mL/ac	-	Cotegra @ 280mL/ac	-	-
Insecticide:	-	-	12-Jul-25	Desis 5 EC @ 80 mL/ac (cabbage seedpod weevil)	03-Jul-25	Matador @ 14 mL/ac	27-Jun-25	Volaim Xpress @ 90 mL/ac (preventative)
Desiccation:	05-Sep	Reglone ION @ 0.83 L/ac	08-Sep-25	Roundup Weathermax @ 0.67 L/ac	-	Reglone ION @ 0.83 L/ac	20-Aug-25	Reglone Ion @ 0.69 L/ac + LI700
Combining Date:	14-Sep-25		20-Sep-25		01-Oct-25		04-Sep-25	

Appendix II: Soil Test Data

Table #. Spring soil test data from Scott Indian Head, Outlook and Swift Current in 2025.

		Scott	Indian Head	Outlook	Swift Current
Soil Zone		Dark Brown	Black	Dark Brown	Brown
Nitrate (NO3)- 0-6" depth	lbs/ac	17	7	26	15
Nitrate (NO3)- 6-24" depth		15	12	31	60
Phosphorus (Olsen)	ppm	13	6	19	22
Potassium	ppm	176	594	190	326
Sulphur- 0-6" depth	lbs/ac	16	6	120 +	18
Sulphur- 6-24" depth		72	24	120 +	54
Chloride - 0-24"	lbs/ac	12	36	-	8
Organic Matter	%	3.6	4.9	2.5	2.9
pH- 0-6"		5	8	7.7	2.9
pH- 6-24"		7.7	8.1	8	7.6
Cation Exchange Capacity	meq	6.3	49.4	22.8	13.1

Appendix III: Climate Data

Table #. Mean monthly temperature (°C) for May – September in Scott, Indian Head, Outlook and Swift Current in 2025.

Year	April	May	June	July	August	September	Average/Sum	% of Long-term Average
-----Temperature (°C) -----								
2024	10.2	12.9	14.6	15.8	17.4	17.5	13.6	
Scott Long-term^z	3.8	10.8	14.8	17.3	16.3	11.2	12.4	110%
2024	2.8	12.7	15.3	17.0	17.8	15.3	15.7	101%

Indian Head	Long-term^z	4.2	10.8	15.8	18.2	17.4	11.5	15.6	
	2024	5.5	13.6	16.2	17.4	19	16	14.6	
Outlook	Long-term^z	4.3	11.3	16.2	18.7	17.9	12.9	13.6	107%
	2024	6.1	13.1	15.9	18	19	16.7	14.8	
Swift Current	Long-term^z	4.04	11.85	16.4	19.05	18.68	14	14.0	106%

Table #. Mean monthly precipitation (mm) for May – September in Scott, Indian Head, Outlook and Swift Current in 2025.

	Year	April	May	June	July	August	September	Average/Sum	% of Long-term Average
-----Precipitation (mm)-----									
Scott	2024	2.2	11.8	103.7	28.7	64.5	64.5	279.5	
	Long-term^z	24.4	38.9	69.7	69.4	48.7	26.5	277.6	101%
Indian Head	2024	29.2	42.6	39.4	27.1	26.9	43.1	136.0	
	Long-term^z	22.6	51.7	77.4	63.8	51.2	35.3	244.1	56%
Outlook	2024	20	6.2	83.1	59.4	60.9	3.9	233.5	
	Irrigation	20	6.2	63.5	25.4	12.7	3.9	101.6	133%
	Long-term^z	18.52	41.0	62.7	54.7	43.2	30.9	251.1	
Swift Current	2024	39.5	34.2	31.3	78.2	92.6	0.8	276.6	
	Long-term^z	22.53	47.48	55.99	56.34	37.99	32	252.33	110%

Appendix IV: Extension Events

Featured by Amber Wall on “Walk The Plots” Radio Show with Glenda Lee Allan on CKSW 570, Magic 97.1 and Country 94.1 throughout the summer

Featured by Chris Holzapfel on Indian Head Field Day on July 15, 2025 with 157 attendees.

Appendix V: References

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7. Abstract (350 words)

Chlorine (Cl) is an essential micronutrient involved in physiological processes in canola, including photosynthesis, stomatal regulation, enzyme activation, and disease resistance. Although chloride (Cl⁻) deficiency is considered rare in Saskatchewan, emerging research suggests it may play a greater role in plant growth and stress tolerance. Potassium chloride (KCl; 0-0-60) is the most commonly used fertilizer source supplying both potassium (K) and chloride; however, concerns about chloride management, soil variability, and equipment wear have increased interest in alternative potassium fertilizers with lower or differing chloride content. This study evaluated potassium chloride replacement products and their effects on chlorine uptake, crop development, yield, and grain quality in canola. Field trials were conducted in 2025 at four Saskatchewan locations: Scott, Indian Head, Swift Current, and Outlook. The experiment used a RBCD with four replications and the treatments included an untreated control and four potassium fertilizer sources (KCl, Pegasus, K-Mag Premium, and Aspire), each applied at two rates (13 and 26 lbs K₂O/ac). Measurements included plant density, canopy closure, tissue chloride and potassium concentrations, grain yield, and seed quality parameters (protein, oil content, and test weight). Across locations, potassium source and rate had limited and inconsistent effects on crop establishment and canopy development. Differences in plant density were observed at Scott and Swift Current, and canopy closure varied at Outlook, but these responses were not consistent across sites. Tissue analysis showed clearer treatment effects. Chloride concentrations increased significantly with chloride-containing fertilizers and higher application rates, particularly at Indian Head and Swift Current. When combined across locations, fertilizer source and rate significantly affected tissue Cl levels, with KCl, Pegasus, and Aspire producing higher chloride concentrations than K-Mag Premium. In contrast, tissue potassium levels were not significantly affected by treatment. Grain yield and seed quality were not significantly influenced by potassium source or rate at any site or across locations. Although some treatments produced slightly higher numerical yields, these differences were not statistically significant. Overall, potassium fertilizer source influenced plant chloride uptake but did not consistently affect yield or grain quality. These results suggest that fertilizer selection should prioritize chloride management and site-specific nutrient requirements rather than expectations of consistent yield response.

8. Finances

- See expenditure statement for financial breakdown