

2. Summary of Research Results 2022

Snow stayed longer (even in May) this year as compared to previous years, and May was wet (108.7 mm rain); as a result of which seeding was delayed to the second week of June. June, July and August were too dry with only 140.4 mm rain during the three months (main growing season) – lowest ever! As a result, the crop yields were poor to low. GDD and CHU during June to September were 1,179 and 2,037, respectively.

2.1 Screening of crop varieties:

2.1.1 Spring Cereals:

Canadian Western Red Spring (CWRS) Wheat Varieties:

- Fifteen CWRS wheat varieties were evaluated for their production potential.
- Grain yields in the highest yielding varieties were in the order of *AAC Starbuck* (4.17 MT/ha) \geq *SY Gabbro* (3.73 MT/ha) \geq *CDC SKRush* (3.65 MT/ha). Grain yield in other varieties ranged from 2.51 MT/ha in *AAC Hockley* to 3.58 MT/ha in *AAC Leroy*.
- *AAC Starbuck* (7.19 MT/ha) and *AAC Leroy* (7.12 MT/ha) produced higher straw yield than all other varieties (3.43 MT/ha in *CS Resolve* to 5.69 MT/ha in *CDC SKRush*
- Averaged over 2021-2022, *Brandon* (4.83 MT/ha), *AAC Starbuck* (4.69 MT/ha) and *CDC SKRush* (4.46 MT/ha) were the three top grain yielding varieties. Only *AAC Starbuck*, *AAC Leroy* and *CDC SKRush* gave more than 6 MT/ha straw yield.
- Three varieties (*Brandon*, *AAC Starbuck* and *AAC Wheatland*) that were common during 2019-2022 more or less equaled in grain (4.43-4.66 MT/ha) and straw (5.13-5.84 MT/ha) yields.
- Area producers could add *AAC Starbuck* to their wheat portfolio.

New Canadian Western Red Spring (CWRS) Wheat Varieties:

- Five CWRS wheat varieties (*AAC Wheatland*, *Brandon*, *Rednet*, *AAC Redberry* and *AAC Leroy*) were compared for their production potential.
- Highest grain (4.26 MT/ha), straw (6.15 MT/ha) and biomass (10.41 MT/ha) yields were obtained with *AAC Redberry*. However, the grain, straw and biomass yield differences among all varieties were not significant.
- Grain yields in other varieties ranged from 3.72 MT/ha in *AAC Leroy* to 3.99 MT/ha in *Brandon*. Straw yield varied from 5.18 MT/ha in *AAC Leroy* to 6.03 MT/ha in *AAC Wheatland*.
- Grain protein content was in the order of *Rednet* (17.31 %) > *Brandon* (16.75 %) > *AAC Wheatland* (16.19 %).
- *Since it is only the first year of testing AAC Redberry, it cannot yet be recommended for cultivation on farms!*

Effect of Mixed Cultivation of Spring Wheat Varieties:

- Three varieties (*AAC Wheatland*, *Brandon* and *Rednet*) were compared singly and in mixtures with each other in different proportions in 10 treatments.
- *Rednet* recorded the highest grain (5.36 MT/ha), straw (9.78 MT/ha) and biomass yields (13.54 MT/ha).
- *Grain yield from Rednet was 16.8 % higher than that from Brandon!*
- None of the mixtures of the three varieties exceeded grain, straw or biomass yields than that from *Rednet*.

Barley Varieties:

- Fifteen barley varieties were compared for their production potential.
- *AB Wrangler* (4.31 MT/ha), *Chambly* (4.11 MT/ha) and *Boroe* (4.06 MT/ha) were the three top grain yielding varieties.
- *Synasolis* had the highest straw yield (6.34 MT/ha). *AB Wrangler* (5.68 MT/ha) and *TRI867* (5.62 MT/ha) were the two next best varieties for straw production.

- Biomass yield (10.34 MT/ha) was highest with *Synasolis*; followed by *AB Wrangler* (9.98 MT/ha), *Chambly* (9.72 MT/ha), and *Boroe* (9.65 MT/ha).
- Eight varieties (*AB Wrangler*, *AB Cattelac*, *Amberly*, *Boroe*, *CDC Bow*, *Chambly*, *Oceanik* and *Synasolis*) were common during 2019-2022. Averaged over these 4 years, *Synasolis* (5.74 MT/ha), *Boroe* (5.47 MT/ha) and *Oceanik* (5.33 MT/ha) were the three top grain yielding varieties. However, the straw yield was highest with *Amberly* (6.18 MT/ha). Biomass yield ranged from 9.27 MT/ha in *CDC Bow* to 11.47 MT/ha in *Amberly*.

Malting Barley Varieties:

- Seventeen varieties were evaluated for grain production. *KWS Kellie* was the new variety in 2022. The two malting barley experiments from last year (Canadian Malting Barley Varieties and California Malting Barley varieties – *Butta 12*, *UC Capay* and *UC Tahoe*) were combined into one experiment this year.
- Three top grain yielding varieties were *CDC Fraser* (5.10 MT/ha), *UC Tahoe* (4.87 MT/ha) and *CDC Kindersly* (4.70 MT/ha). *CDC Bow* produced the lowest grain yield (2.99 MT/ha) this year. However, averaged over 2017-2022, *CDC Bow* produced the highest grain yield (5.95 MT/ha). The next two best varieties for grain production on the long run were *AAC Synergy* (5.74 MT/ha) and *CDC Kindersly* (5.63 MT/ha).
- *CDC Copeland* recorded the highest straw yield (10.8 MT/ha). *CDC Kindersly* (7.74 MT/ha), *KWS Kellie* (7.61) and *CDC Copper* (7.57 MT/ha) were also good for straw production. Averaged over 2017-2022, *CDC Bow* (7.58) and *CDC Copeland* (7.27) produced the highest straw yield.
- Diseases (BYDV, Net Blotch, Spot Blotch and FHB) incidence was nil to negligible.
- Only *Butta12* (13.86 % grain protein) exceeded the grain protein limit of 13.0 %. In all other varieties, grain protein content ranged from 10.17 % in *CDC Copper* to 12.14 % in *UC Tahoe*. For other malt quality parameters please refer to the main report.

Oat Varieties:

- Ten oat varieties were evaluated for their yield potential. *CDC Endure*, which has good milling qualities and high beta glucan levels that end users require to make heart healthy products like breakfast cereals, was one of these varieties.
- *AAC Excellence*, *AAC Reid*, *AAC Justice* and *AAC Kongsore* were the new varieties this year.
- *AAC Kongsore* (3.78 MT/ha), *AAC Douglas* (3.48 MT/acre) and *AAC Justice* (3.37 MT/ha) produced the highest grain yields. *AAC Douglas* recorded the highest straw yield (6.20 MT/ha) followed closely by *AAC Kongsore* (5.58 MT/ha). Biomass yield followed the same trend as the straw yield.
- Averaged over 2020 to 2022, there was no significant difference in the grain, straw and biomass yields of the five varieties (*AC Rigodon*, *CDC Arborg*, *Akina*, *CDC Skye* and *AAC Douglas*) common during these years.
- *Oat growers could grow any of the five varieties mentioned in the previous bullet point in 2023.*

2.1.3 Grain Legumes and Oil Seeds Varieties:

Soybean Varieties (Seeded on June 14, 2022):

- Twenty four varieties were compared for their grain production potential.
- Grain yields were very poor due to late seeding (June 14) and dry weather.
- Highest grain yields were recorded with *Bourke R2X* (1.49 MT/ha) and *Lono R2* (1.43 MT/ha).
- Averaged over 2019-2022, *Lono R2* (2.99 MT/ha) and *Bourke R2X* (2.91 MT/ha) gave the highest grain yields.
- *Mahony R2* (17.8 g) and *Bourke R2X* (17.3 g) had the highest 100 kernel weight.
- *Lono R2* was the tallest variety (95 cm)!
- *Area producers could grow both Bourke R2X and Lono R2 on their farms!*

Linseed Flax Varieties (Seeded on June 7, 2022):

- Twelve varieties of linseed flax were compared.

- Flax seed yield was dismally low this year, due to late seeding and dry weather, and ranged from 0.60 MT/ha in *AAC Marvelous* to 1.03 MT/ha in *CDC Neela*.
- Straw (4.01 MT/ha) and biomass (4.58 MT/ha) yields were the highest with *CDC Melyn*.
- Averaged over 2021 and 2022, *CDC Rowland* gave the highest seed yield (1.38 MT/ha) and *AAC Prairie Sunshine* produced the highest straw (6.02 MT/ha) and biomass (6.82 MT/ha) yields.
- Good crop growth as indicated by the high straw yield couldn't be converted into good seed yield due to dry weather and short growing season.

Liberty Canola Varieties (Seeded on June 11, 2022):

- Twelve varieties were evaluated; some of them new and half of which had Clubroot resistance/or shatter reduction trait.
- Delayed seeding (prolonged winter and wet May) and dry weather (total rainfall during June and July 87 mm only) kept the seed yields low (trial mean 2.61 MT/ha). Growth as seen from straw yield (7.69 MT/ha) didn't get converted into seed yield.
- Seed yield was in the order of *LA344PC* (3.34 MT/ha) \geq *L357P* (3.09 MT/ha) = *P501L* (3.09 MT/ha). Seed yield in other varieties ranged from 1.98 MT/ha in *L340PC* to 2.79 MT/ha in *L252*.
- *L357P* recorded the highest straw yield (9.55 MT/ha). Straw yield in other varieties ranged from 6.11 MT/ha in *DKLL-82SC* to 9.12 MT/ha in *LA356PC*.
- Averaged over 2018-2022, three top seed yielding varieties were *L252* (3.86 MT/ha), *P501L* (3.01 MT/ha) and *LA344PC* (2.90 MT/ha). Straw yield was higher with *L357P* (8.39 MT/ha) and *LA344PC* (8.12 MT/ha) than with the other varieties (6.12-7.61 MT/ha).
- *P* stands for 'Shatter Reduction' and *C* for 'Clubroot Resistance'.

Roundup Ready Canola Varieties (Seeded on June 11, 2022):

- Eight varieties were compared for their production potential.
- Three top seed yielding varieties were *6086CR* (3.62 MT/ha), *BY6204TF* (3.24 MT/ha), and *CS2300* (2.89 MT/ha). Seed yield in other varieties ranged between 1.95 to 2.78 MT/ha.
- Straw yield was highest with *BY6204TF* (11.82 MT/ha).
- Averaged over 2020 to 2022 (7 varieties), *CS2600CR-T* (3.55 MT/ha), *LR344PC* (3.46 MT/ha) and *BY6204TF* (3.11 MT/ha) gave higher seed yield than the other varieties. Highest straw yield was obtained with *CS2300* (8.25 MT/ha) and *BY6076CR* (8.23 MT/ha).
- *CR* stands for Clubroot resistance and *TF* for Truflex.

Clearfield Canola Varieties (Seeded on June 13, 2022):

- Five varieties were compared for their production potential.
- Seed yield was in the order of *5545CL* (3.47 MT/ha) \geq *2028CL* (2.92 MT/ha) \geq *CS2500CL* (2.82 MT/ha). Straw yield was highest (7.77 MT/ha) with *5545CL*.
- Averaged over 2021-2022, *5545CL* produced the highest seed (2.85 MT/ha), straw (6.40 MT/ha) and biomass (8.92 MT/ha) yields.

2.1.4 Forage Crops/Varieties:

Barley Varieties for Forage Production:

- Fifteen varieties were evaluated for forage production.
- Highest forage dry matter yield was registered by *Amberly* (11.30 MT/ha; 8.4 % protein), *AB Advantage* was the next best high forage yielding variety (9.30 MT/ha; 10.9 % protein).
- Averaged over 2021-2022, *Amberly* (9.51 MT/ha), *AB Tofield* (9.29 MT/ha) and *Oceanik* (9.24 MT/ha) were the three top forage producing varieties.
- *AB Tofield* (13.4 %), *AB Hague* (13.1 %) and *TR1867* (12.4 %) had a high protein content.
- RFV was highest in *Oceanik* (173) followed by *AB Cattelac* (151).
- *Considering the dry matter yield and protein content, AB Tofield (6 row barley; a dual purpose grain and forage variety) can be recommended for forage production! AB Tofield seed can be obtained from SeCan.*

Malting Barley Varieties for Forage Production:

- Same malting varieties that were evaluated for grain production were tested for forage production.
- Highest forage dry matter yield (11.18 MT/ha) was obtained with *CDC Churchill* followed closely by *AB Brewnet* (10.72 MT/ha). *AAC Goldman* (9.95 MT/ha) was the next best variety for forage production.
- Averaged over 2021-2022, *CDC Churchill* (10.69 MT/ha) and *CDC Copper* (10.18 MT/ha) produced the highest forage dry matter yields. *AB Brewnet* yield (10.03 MT/ha) was pretty much the same as *CDC Copper*.
- *Butta 12* (13.5 %), *CDC Fraser* (12.0 %) and *CDC Copper* (11.2 %) had higher protein content than the other varieties (7.5 % to 10.5 %).
- *CDC Copper* had the highest RFV (167) followed closely by *CDC Churchill* (159).
- *Considering the dry matter yield, and RFV, CDC Copper can be recommended for forage production! CDC Copper is a dual purpose variety (grain and forage production) and its seed can be procured from FP Genetics.*

Alfalfa Varieties (Seeded in 2020): Two cuts were taken!

- Two western alfalfa varieties (*Revolution MD* and *Response WT*) were compared with two Atlantic Canadian varieties (*AAC Trueman* and *Elite*); *WL319HQ* (RR alfalfa) was a check variety.
- Dry matter yield from two cuts varied from 3,355 kg/ha with *AAC Trueman* to 3,970 kg/ha with *Revolution MD*. Two other varieties that produced similar yields to *Revolution MD* were *Elite* (3,938 kg/ha) and *Response WT* (3,857 kg/ha). Based on average of the two years (2021 and 2022), *Response WT* (4,561 kg/ha) gave the highest and *AAC Trueman* (4,089 kg/ha) the lowest dry matter yield. However, the yield differences between the varieties were not statistically significant.
- First cut protein content varied from 19.3 % in *WL319HQ* to 22.1 % in *AAC Trueman* and from 19.7 % in *Elite* to 21.6 % in *WL319HQ* in the second cut.
- RFV was highest in *AAC Trueman* (133) in the first cut and highest in *WL319HQ* (132) in the second cut. Generally speaking, higher RFV could mean higher milk yield.
- *Considering the protein content and RFV, AAC Trueman can be recommended for cultivation on farms.*

Alfalfa Varieties (Seeded in 2021): Two cuts were taken!

- Six alfalfa varieties were compared for their forage yield and quality.
- *Shockwave BR* gave the highest (4,193 kg/ha) and *Evermost* (3,355 kg/ha) the lowest dry matter yield. However, the yield differences between the varieties was not statistically significant.
- Protein content in the first cut ranged from 21.4 % in *Shockwave BR* to 23.5 % in *135*.
- Second cut protein content was the lowest (20.7 %) in *135* and highest (22.8/22.7 %) in *Revolution MD/Dynasty*.
- *Evermost* had the highest RFV (168) in the first cut and *Revolution MD* had the highest RFV (139) in the second cut.

Comparative Performance of Alfalfa and Galega (Seeded in 2011): Two cuts were taken!

- *Galega* gave ~500 kg/ha higher dry matter yield than *alfalfa*, which was more grass than alfalfa. Alfalfa stand had become scanty over the years.
- Averaged over 2012 to 2022, *Galega* (5,070 kg/ha/year) produced higher dry matter yield than *alfalfa* (4,574 kg/ha/year).
- *Galega* had 2.6 % point higher protein content in the first cut and 1.7 % point higher protein content in the second cut as compared to *alfalfa*.
- RFV was somewhat higher in *alfalfa* (132) than *Galega* (127) in the first cut, whereas in the second cut RFV was more or less the same in *alfalfa* (136) and *Galega* (135).
- *Higher yield and higher protein content in Galega than in alfalfa, could make Galega a better fodder than alfalfa!*

Alternate Forage Legumes (Seeded in 2020): Two cuts were taken!

- *Galega*, *sainfoin*, *alfalfa* and *red clover* were compared for their production potential and forage quality. *Sainfoin* and *Red Clover* didn't survive the 2021-2022 winter.
- Dry matter yields from *Galega*, *alfalfa* and *Trefoil* were 2,449, 2,411 and 1,788 kg/ha.
- In the first cut, *Galega* had 1.3 % point higher protein content than *alfalfa* and *Trefoil* had 1.6 % point higher protein content than *alfalfa*.
- Second cut protein content was highest (25.1 %) in *Galega* and lowest in *alfalfa* (19.8 %).
- RFV in the first cut was highest (144) in *alfalfa*, whereas in the second cut, *Trefoil* had the highest RFV (153).

Corn Silage Varieties:

- Due to late start of the season 2022, this experiment couldn't be conducted this year.
- *From the last year's results, considering the dry matter yield, protein content and other quality parameters, PS 2320 could be recommended for cultivation on farms!*

Optimizing Seeding Rate in Kernza and Comparing its Forage Production Potential with Perennial Rye and in Mixture with Alfalfa (Seeded in 2017):

- In the *Kernza* alone treatments, regrowth of *Kernza* was too poor to take the second cut. Therefore, only one cut was taken.
- Based on results from 2018 to 2022, optimum seed rate of *Kernza* appeared to be 90 seeds/m². At this rate, it produced a total of 17,757 kg/ha dry matter yield. Dry matter yield from *Kernza* at other populations (70, 110 and 130 seeds/m²) varied from 15,003 kg/ha to 17,399 kg/ha.
- *Alfalfa + Kernza* (80:20 mixture) recorded the highest dry matter yield (4,128 kg/ha) in 2022 and also highest total dry matter yield over five years (2018-2022) – 23,892 kg/ha = 4,778 kg/ha/year. Dry matter yield from *alfalfa + Ace 1* (*Perennial Rye*) 80:20 mixture was 3,771 kg/ha in 2022. However, *Ace 1* did not survive beyond winter 2018-2019 and *alfalfa + Ace 1* was virtually *alfalfa* alone.
- In the first cut, protein content was higher in *alfalfa + Ace 1* (80:20) mixture (24.0 %) followed by *alfalfa + Kernza* (80:20 mixture) – 21.1 %. Protein content in *Kernza* alone ranged from 15.9 % to 20.3 %.
- In the second cut, *alfalfa + Kernza* (80:20 mixture) had lower protein content (15.5 %) than *alfalfa + Ace 1* (80:20) mixture (22.2 %)
- First cut RFV was highest in *alfalfa + Kernza* (80:20 mixture) – 118; higher by 5-14 than the other treatments. In the second cut, higher RFV (138) was recorded with *alfalfa + Ace 1* (80:20 mixture) than with *alfalfa + Kernza* (80:20) mixture (111).

Union Forage (Seeded in 2021): Two cuts were taken!

- Twelve treatments involving forage legumes alone or blends of legumes/and grasses were evaluated for forage production and feed quality.
- Dry matter yield from two cuts ranged from 1,382 kg/ha with grasses blend (50% *Timothy*, 42.5% *Brome Grass*, 7.5% *Orchard Grass*) to 3,819 kg/ha with legumes blend (75% *Grazing Alfalfa*, 25% *AAC Sainfoin*). Two treatments that closely followed 75% *Grazing Alfalfa* + 25% *AAC Sainfoin* in the dry matter yield were 50% *Grazing Alfalfa* + 50% *AAC Sainfoin* (3,463 kg/ha) and 1615 *GrazeMaster* (70% 43 *Soft Leaf Tall Fescue*, 30% *HLR Orchard Grass*) – 3,457 kg/ha.
- *Grazing Alfalfa* had the highest protein content in the first (22.4 %) as well as in the second cut (23.4 %). Two other treatments that had high protein content in the first cut were 75% *Grazing Alfalfa* + 25% *AAC Sainfoin* (21.9 %) and a multi grass blend - 40% *Arsenal Meadow Brome*, 30% 43 *Soft Leaf Tall Fescue*, 20% *HLR Orchard Grass*, 10% *San Luis Slender Wheat Grass* (21.5 %). In the second cut, 75% *Grazing Alfalfa* + 25% *AAC Sainfoin* (23.2 %) and 50 % *Grazing Alfalfa* + 50 % *AAC Sainfoin* were close to *Grazing Alfalfa* in the protein content (22.6 %).

- RFV was the highest (151) in the multi grass blend - 40% Arsenal Meadow Brome, 30% 43 Soft Leaf Tall Fescue, 20% HLR Orchard Grass, 10% San Luis Slender Wheat Grass, whereas in the second cut RFV was the highest in *Trefoil* (154-155).

2.2 Fertilizer Management Practices and Growth Regulators/Biostimulants (Grain/Seed crops):

2.2.1 Spring Cereals:

Comparative Performance of Manipulator and Moddus at Two Rates of Nitrogen (80 and 160 kg N/ha) in Spring Wheat (Brandon) and Spring Barley (Boroe):

- Barley supplied with 80 kg N/ha and sprayed with Moddus @ 1.03 l/ha at 5-6 leaf stage produced the highest grain yield (6.70 MT/ha). Straw yield was highest (8.72 MT/ha) with barley @ 160 kg N/ha without any application of Manipulator or Modus.
- Highest biomass yield (13.93 MT/ha) was registered with barley @ 160 kg N/ha sprayed with Manipulator @ 2.3 l/ha at 5-6 leaf stage.
- Grain yield in wheat with or without Manipulator spray didn't improve by the application of N @ 80 or 160 kg N/ha. However, straw yield increased with the increasing rates of N application, more so with the Manipulator spray @ 1.8 l/ha at 5-6 leaf stage.
- Grain yield in barley without Manipulator or Moddus spray was not affected by the application of N; though the straw yield in this case appeared to improve @ 160 kg N/ha as compared to no N application.
- When sprayed with Moddus, barley grain yield, but not the straw yield, increased by 1.25 MT/ha with the application of N @ 80 kg N/ha as compared to no N application.
- When sprayed with Manipulator, increase in barley grain yield with the application of N was insignificant; though N application @ 160 kg N/ha increased the straw yield by 0.84 MT/ha.
- Averaged over N rates and Manipulator/Moddus treatments, barley gave higher grain (by 3.43 MT/ha), straw (by 1.50 MT/ha) and biomass (by 4.38 MT/ha) yields than wheat.
- Averaged over crops and Manipulator/Modus treatments, grain yield didn't increase significantly but straw yield increased considerably (0.64 MT/ha) with the application of N @ 80 or 160 kg N/ha.
- Averaged over crops and N rates, Moddus increased the grain, but not the straw, yield by 2.29 MT/ha. Straw yield improved by 0.64 MT/ha with the application of Manipulator, which didn't increase the grain yield. Manipulator lowered the plant height by 8 cm and Moddus reduced the plant height by only 2 cm.
- Averaged over years (2021-2022) and other factors, barley gave 1.62 MT/ha higher grain yield and ~0.90 MT/ha higher straw yield than wheat. Application of N had only a nominal effect on grain and straw yield. Moddus not Manipulator increased the grain yield by 0.86 MT/ha. Effect of Moddus and Manipulator on straw yield was insignificant. Moddus reduced the plant height by 8 cm and Manipulator by 5 cm.
- *Moddus could be preferred to Manipulator and Moddus spray in wheat at 0.83 L/ha and 1.03 L/ha in barley at 5-6 leaf stage could be recommended to the area producers!*

Evaluation of Urea, ESN, Urea SuperU, Their Blends and Anvol Treated Urea for Production of Spring Wheat:

- Urea, ESN and Urea SuperU, their blends and Anvol treated urea were compared at 80 and 120 kg N/ha. A no N check was also kept.
- Three top grain yielding treatments were ESN @ 80 kg N/ha (4.18 MT/ha), urea @ 80 kg N/ha + ESN @ 40 kg N/ha (4.04 MT/ha) and urea @ 80 kg N/ha (3.97 MT/ha). The yield and response to N was low due to late seeding, lack of moisture during the growing season and reasonably good pre-seeding N tests (Nitrate N: ~18 ppm and ammoniacal N: ~9 ppm).
- Straw yield was highest with urea @ 120 kg N/ha (5.94 MT/ha) and ESN @ 120 kg N/ha (5.84 MT/ha).

- Averaged over N sources, 120 kg N/ha significantly increased the straw, but not the grain, yield as compared to the check (No N).
- Averaged over N rates, urea (3.80 MT/ha), urea + ESN (3.66 MT/ha) and urea + urea superU (3.69 MT/ha) seemed to give higher grain yields than the other treatments.
- Urea superU didn't prove better than urea or ESN.
- Anvol treated urea gave the lowest grain yield (3.07 MT/ha). It seems Anvol made urea too slow.

Residual Effect of MAP + MST Applied to Canola (2021) on Spring Wheat (2022):

- Grain yields were too low (due to late/direct seeded crop without tillage and lack of soil moisture) to draw any meaningful conclusions. However, the indications were that (i) S applied to canola @ 36 kg S/ha improved the wheat grain yield, and (ii) ammonium sulphate was a better source of S than MAP + MST.

Residual Effect of Symtrex Applied to Canola (2021) on Spring Wheat (2022):

- Grain yields were too low (due to direct/late seeded crop without tillage and lack of soil moisture) to draw any meaningful conclusions. However, the indications were that (i) S applied to canola @ 36 kg S/ha improved the wheat grain yield, and (ii) ammonium sulphate was a better source of S than Symtrex.

2.2.2 Winter Cereals:

- *Only one experiment on evaluation of high efficiency N fertilizers and Anvol (a urease inhibitor) in winter wheat could be seeded in 2021. Most of the plots were winter killed because of a prolonged winter/snow staying on ground till May. Hence, the experiment was a failure.*

2.2.3 Canola:

Effect of Apex, Top Phos, EXCELIS MAXX and Bio-Stimulants on Canola:

- Apex (30 % N - 5 % ammoniacal N and 25 % urea N, 2.9 % Ca, 1.2 % Mg and 8 % S), or Top Phos (8 % N, 30 % P₂O₅, 0 % K₂O and 4.8 % S) applied at equivalent rates of N/or P from other fertilizers (urea, ESN, ammonium sulphate and 0-45-0) didn't give higher canola seed yield than the fertilizers used by our growers (urea, ESN, ammonium sulphate and 0-45-0/or 11-52-0).
- Seed yield was low due to late seeding and dry weather (Trial mean 2.48 MT/ha).
- Application of N from three sources (urea, ESN and ammonium sulphate) along with conventional P and K fertilizers resulted in the highest seed yield (3.21 MT/ha). Straw yield with this treatment (10.57 MT/ha) equaled that from the ESN, urea, AS and Top Phos treatment (10.91 MT/ha, which was numerically the highest straw yield).
- Top Phos was no better source of P than 0-45-0.
- Apex or a blend of urea, ESN and urea SuperU, on equal N basis, didn't prove better than the N fertilizers (urea, ESN and ammonium sulphate) blend used by our area farmers.
- Biostimulants (FA Starter, IRYS, FL Gold and Genea) didn't improve canola seed yield.
- EXCELIS MAXX treated urea seemed to improve canola seed yield as compared to untreated urea, though the yield differences between the two treatments were insignificant.
- Averaged over 2020-2022, none of the treatments were significantly better than farmers' practice of applying N from three sources (urea, ESN and ammonium sulphate) along with conventional P and K fertilizers.

Evaluation of MAP + MST as a Source of S for Canola (Cultivar CS3000TF) Production:

- MAP + MST (9-43-0-16), a blend of MAP (11-52-0) and MST (micro-ionized elemental S) was compared with ammonium sulphate and in blends with ammonium sulphate @ 36 kg S/ha.
- Canola seed yield with MAP + MST (4.10 MT/ha) equaled that from ammonium sulphate (4.23 MT/ha) or a blend of ammonium sulphate @ 24 kg S/ha + MAP + MST @ 12 kg S/ha (4.31 MT/ha).
- MAP + MST produced the highest straw yield (10.79 MT/ha).

- Averaged over S sources, 36 kg S/ha didn't increase the seed yield, but increased the straw yield by 66.6 % and biomass yield by 43.9 %. It seems that good vegetative growth couldn't translate itself to good seed yield due to lack of soil moisture (dry weather).
- Averaged over rates of S application, *MAP* + *MST* improved the seed yield by 0.5 MT/ha as compared to that from *ammonium sulphate*.
- Averaged over 2021 and 2022, seed yield wasn't significantly affected by sources or rates of S application. However, S @ 36 kg/ha increased the straw yield significantly by 1.81 MT/ha. Both the years were relatively dry and the vegetative growth couldn't convert itself to the seed yield.

Evaluation of SymTRX S10 as a Source of S for Canola (Cultivar CS2600CRT) Production:

- *SymTRX S10* (14-24-0-10), a bio-based fertilizer containing 16 % O.M that could increase microbial activity, was compared with ammonium sulphate and in blends with ammonium sulphate.
- *Ammonium sulphate* alone @ 36 kg S/ha or in combination with *SymTRX S10* (24 kg S/ha from ammonium sulphate and 12 kg S/ha from *SymTRX S10*) gave 1 MT/ha higher seed yield than *SymTRX S10* @ 36 kg S/ha.
- Averaged over sources/blends of S sources, application of S @ 36 kg S/ha increased the straw yield (by 1.35 MT/ha) more than the seed yield (by 0.60 MT/ha). It seems due to dry weather vegetative growth wasn't fully translated to the seed yield.
- Seed yield with *ammonium sulphate* was 5.47 MT/ha and that with *SymTRX S10* was 4.45 MT/ha.
- *Ammonium sulphate* produced 2.26 MT/ha higher straw yield than *SymTRX S10*.
- Averaged over 2021 and 2022, seed and straw yields had the same trend as in 2022.

2.2.4 Forages:

Alfalfa Row Spacing and Rates of Sulphur (S) Application (Seeded in 2020):

- Pre seeding S test in this experiment was 8 ppm S.
- Seed rate was kept the same with all the row spacing treatments. Highest alfalfa dry matter yield (4,982 kg/ha) from two cuts was obtained with missing one row after every two rows and application of S @ 36 kg/ha. First cut protein content was higher (20.7 - 21.0 %) with 15 cm row spacing and 24 kg S/ha, missing alternate rows with 36 kg S/ha and 15 cm row spacing and 48 kg S/ha than with the other treatments (17.4 - 20.4 %). In the second cut, 15 cm spacing or missing one row after every two rows with 24 kg S/ha produced higher protein content (24.4/23.9 %) than the other treatments (21.4 - 23.6 %).
- In the first cut, RFV was the highest (149) with 15 cm row spacing and 48 kg S/ha. In the second cut, 15 cm row spacing and 24 kg S/ha had the highest RFV (138).
- Averaged over S rates, missing one row after every two rows produced the highest first cut yield (2,783 kg/ha), whereas regular row spacing at 15 cm recorded the highest second cut yield (1,921 kg/ha).
- Dry matter yield from the two cuts was in the following order: missing one row after every two rows (4,483 kg/ha) ≥ regular rows - without missing any rows (4,331 kg/ha) ≥ missing alternate rows (3,796 kg/ha).
- Protein content with different row spacing/geometries varied from 19.6 to 20.1 % in the first cut and from 22.7 to 22.9 % in the second cut.
- RFV was highest with missing one row after very two rows in the first cut (136) and highest without missing any rows in the second cut (125).
- Averaged over row spacing, application of S @ 36 kg/ha recorded the highest alfalfa dry matter yield from the two cuts (4,562 kg/ha). However, rates of S didn't have any significant differences in the alfalfa dry matter yield. Protein content was highest with 24 kg S/ha both in the first (20.4 %) and in the second cut (24.0 %). RFV in the first cut was highest (140) with S @ 48 kg S/ha, whereas in the second cut, RFV was highest with 24 kg S/ha (130).

2.3 Other Agronomic Practices:

Effect of Fungicides on Diseases and Yield in Spring Cereals:

- Stratego (sprayed at tillering), Prosaro (sprayed at anthesis) and Caramba sprayed a week later than Prosaro were used to control foliar fungal diseases and FHB in spring cereals – wheat (*AAC Wheatland*), barley (*CDC Bow*) and oats (*AC Rigodon*); (total 12 treatments).
- There was hardly any disease incidence because of dry summer; FHB score in particular was zero. Despite that, fungicides (Stratego alone or in combination with Prosaro and Caramba) improved wheat and oats grain yield significantly, whereas grain yield did not improve by the fungicides spray in barley. However, straw yield was improved significantly in all the three crops with the spray of Stratego and Prosaro (4.56 MT/ha in wheat, 8.55 MT/ha in barley and 7.65 in oats); but not by spraying Stratego alone.
- Highest grain yield of wheat (3.66 MT/ha) and oats (7.79 MT/ha) was recorded with the spray of the three fungicides (Stratego, Prosaro and Caramba). Stratego spray alone resulted in highest grain yield (3.99 MT/ha) in barley.
- Averaged over fungicides, grain yield was in the order of oat (*AC Rigodon* 5.76 MT/ha) > barley (*CDC Bow* 3.69 MT/ha) > wheat (*AAC Wheatland* 2.99 MT/ha). Barley produced the highest (7.18 MT/ha) and wheat the lowest (4.09 MT/ha) straw yield.
- Averaged over crops, highest grain (6.92 MT/ha) and straw (9.15 MT/ha) yields were registered by spraying two fungicides (Stratego and Prosaro).
- Averaged over 2020 to 2022, in the three cereals, grain yield was in the order of oat (*AC Rigodon* 5.42 MT/ha) > barley (*CDC Bow* 4.11 MT/ha) > wheat (*AAC Wheatland* 3.64 MT/ha). Barley/and oats produced the highest (9.58/9.55 MT/ha) and wheat the lowest (6.82 MT/ha) straw yield.
- Averaged over 2020 to 2022 and over crops, spraying three fungicides produced the highest grain (4.69 MT/ha) and nearly highest straw yield (8.81 MT/ha).
- *In the dry years, it may be advisable to prefer oats to barley and wheat with due consideration to the market prices of the three cereals. Since it is difficult to predict a dry year, wheat and barley farmers may add oats to their cropping systems to spread/or lower risk of low production.*

Optimizing Seeding Rate in Kernza and Comparing its Grain Production Potential with Perennial Rye (Seeded in 2017):

- *Kernza* was seeded @ 70, 90, 110 and 130 seed/m² in 2017.
- *Ace 1* (perennial rye) didn't survive to produce any grain yield.
- *Kernza* grain yield was dismally low (0.30-0.34 MT/ha) this year, due to dry summer and aged crop. However, straw yield was good and maximum straw yield (9.82 MT/ha) was obtained with *Kernza* at a seeding rate of 110 seeds/m².
- Averaged over 2018-2022, seeding *Kernza* @ 110 seeds/m² resulted in a grain yield of 0.68 MT/ha and the straw yield of 11.11 MT/ha.
- *Kernza* grain yield in 2019 was close to 2 MT/ha.

Effect of EcoTea Seed Treatment on Different Crops (Seeded on June 11, 2022):

- EcoTea contains plant beneficial microbes and was applied @ 4 g/kg seed.
- EcoTea appeared to increase grain yield of wheat (*AAC Wheatland*) and barley (*CDC Bow*) and lower the grain yield of Soybean (*Bourke R2X*).
- EcoTea increased the straw yield of wheat and barley by over 1 MT/ha.
- Averaged over EcoTea treatments, barley gave the highest grain (2.91 MT/ha) and straw (6.19 MT/ha) yields.
- Averaged over crops, EcoTea improved grain, straw and biomass yields only marginally.
- Averaged over 2021-2022, EcoTea considerably increased grain, straw and biomass yields of only wheat. Among crops, barley produced the highest grain (3.70 MT/ha), straw (6.37 MT/ha) and biomass (9.41 MT/ha) yields.

Swede Midge Traps Results:

- Meghan Moran, Edible Beans and Canola Specialist OMAFRA, had sent us traps to see if there is any Swede Midge in canola. Traps were put in canola experiments and observations were recorded from July 18 to September 12, 2022.
- Weekly observations revealed that no Swede Midge was found in the traps. All we had in traps was some flea beetles, some spiders and some flies. *This shows that LUARS is free from Swede Midge.*

2.4 Soil Studies:

Optimizing Seeding Rate in Kernza for Grain and Forage Production - Soil Analysis After 6 years of Cropping:

- Soil pH varied from 5.9 in *Kernza* for forage production to 6.2 in *Kernza* for grain production.
- *Kernza* for grain production lowered the organic matter and available nutrients (Mg, P and K and to some extent Zn, Fe and Cu) as compared to *Kernza* for forage production. However, *Kernza* for grain left the highest amount of S (13 ppm) in the soil.
- *Alfalfa + Kernza* for forage improved organic matter a little bit, but lowered the available nutrients (Ca, Mg, P, K, Mn and B) as compared to *Kernza* (alone) for grain or for forage production.
- Nitrate N was dismally low (3 ppm) in all treatments.

2.5 Extension and Outreach:

LUARS, through its research, extension and outreach activities, have made a significant impact for the betterment of the agricultural industry particularly through ‘Crop Diversification’ and adoption of ‘Beneficial Nutrient Management Practices’. Area farmers continued to diversify their cropping systems, adding new crops/and varieties, clearing land and tile drainage. The impact of our Extension and Outreach activities could be seen in the form of favourable changes as follows:

- Thunder Bay Co-op brought in Truckloads of seeds (CDC Bow and CDC Fraser barley), over 400 bags of corn, and several bags of canola (L233P, L255PC and L345PC).
- Thunder Bay Feeds sold 29 MT of Newdale malting barley, 23 MT Brandon wheat, 1 MT Summit oats, 31 bags of canola (cultivars L356 and L252) and 9 bags of PS2320 corn (a new corn silage variety recommended by LUARS) seeds.
- Area farmers continued to diversify their cropping systems! Canola acreage increased to more than 1000 acres in a 25 km radius from LUARS, which brought a dollar value of over \$1,275,000.00 to the area. Jaspers increased their acreage under canola by 1.4 times. Mols doubled their canola acreage this year. Some other growers also increased their acres under canola. Two growers seeded canola for the first time this year; Lorne Vis in 80 acres and John Huisman in 11 acres. This raised the number of canola growers to more than a dozen (Ryan Jaspers, Mark Bolt, Joel/Mark Veurink, Ben Breukelman, Aaron Breukelman, Martin Schep, Jeff Schelhaas, Henry Streutker, Richard Templeman, Gert Brekveld, Dennis Ellchook, Jeff Burke, John Huisman and Lorne Vis). Henry and Peter Aalbers grew oats + peas in 22 acres and Sorghum Sudangrass in 25 acres. Other farmers who grew Sorghum Sudangrass were Mike Huber, Brent Cadeau, Jason Reid and Bill Groenheide. Thora Cartlidge seeded buckwheat in 26 acres for grain production.
- Ryan and Fritz Jaspers seeded ~190 acres Brandon wheat (tested at LUARS), 370 acres under canola (100 acres more by them than last year; largest canola acreage on a single farm) – cultivars L255PC and L356PC, 100 acres corn under biodegradable plastic mulch, 35 acres under Synasolis barley and nearly 142 acres under alfalfa and 160 acres under grass hay. Jaspers created new records by getting 3.25 MT grains/acre from barley and 1.7 MT average canola seed yield/acre from 370 acres of canola (highest so far not only by them but also in the area). In spots, in some fields, they touched 2 MT/acre canola seed yield. This is despite insufficient rain this year. Proper crop rotation, high yielding varieties and best nutrient management practices including supply of N from multiple sources, application of ESN in the seed row, and application of fungicides and plant growth regulators, as recommended by LUARS were the contributing factors towards these record crop

yields. Their Brandon wheat grain yield was more than 2 MT/acre. They obtained average 15 MT/acre yield from 100 acres silage corn, which is pretty good for late seeding and relatively dry season.

- Gerrit Cramer grew more than 300 acres under CDC Bow, a malting barley variety recommended by LUARS and got over 2 MT/acre grain yield, 190 acres under silage corn from which he had 200 loads of harvest, and 150 acres under soybean, part of which was harvested green for forage. His soybean grain yield was 1 MT/acre. Cramer is one of the farmers who have been applying ESN to his crops in the seed row; a beneficial management practice tested at and recommended by LUARS.
- Allan and Henry Mol got 1.5 MT seed yield/acre from 130 acres under canola, which is a pretty good yield. They harvested 140 acres under CDC Fraser barley and obtained 2.5 MT/acre grain yield. They grew CDC Fraser (tested at and recommended by LUARS) for the first time this year. They seeded CDC Bow barley in 70 acres for silage production and got 10.7 MT/acre forage yield, which is quite high. Average corn forage yield from their 65 acres corn field was 10.8 MT/acre, which is understandable from the late seeding due to cold and wet spring. Their alfalfa forage yield was excellent (10 MT/acre from 225 acres).
- Richard Templeman grew Liberty canola (cultivar P505MSL) for the second time in 90 acres and obtained 1.30 MT/acre seed yield (somewhat higher than what he got last year!). He had 25 acres under Brandon wheat and got very good grain yield (2 MT/acre). He harvested 4 round bales/acre from his 25 acre hay field.
- Gert Brekveld grew AAC Wheatland, a high yielding Canadian Western Red Spring wheat variety, recommended by LUARS, for the second time in ~60 acres and got over 2 MT/acre grain yield. His grain yield from the same variety last year was 1.8 MT.
- Fred Breukelman seeded canola in 105 acres and obtained 1.6 MT seed yield/acre; his last year canola yield was 1.4 MT/acre. He also grew 160 acres silage corn under plastic, from which he got 13.5 MT/acre yield.
- Bernie Kamphof didn't harvest any crop this year for grains. He seeded 230 acres under barley and obtained 6 MT/acre silage yield which he is happy with because he was late to seed barley. He seeded 210 acres under silage corn that yielded ~11 MT/acre. Again, seeding this year was late. He had 260 acres under alfalfa/alfalfa grass mix from which he got reasonably good yield(s).
- Jeff Burke under seeded Crimson Clover in spring wheat in one field and one cut clover alone in another field as cover crops and for adding organic matter. He seeded winter rye this fall and is planning to apply wood ash in his most acidic field.
- Evan Grootenboer seeded Esma and Canmore barley varieties; grain yield from Esma was more than 2 MT/acre and that from Canmore was less than 2 MT/acre. He seeded a new ProRich alfalfa variety this year in 35 acres and harvested 65 round bales from one cut. LUARS has tested ProRich alfalfa varieties.
- Mark Veurink seeded 125 acres canola (Invigor L345PC; seed yield 1.4 MT/acre); 40 acres seeded on June 4 and 85 acres seeded on June 9, AB Cattelac barley in 90 acres (grain yield 2.2 MT/acre), 99 acres Brandon wheat (grain yield 2.07 MT/acre overall and 2.5 MT/ha from his best 62 acres), and 150 acres silage corn. His silage corn yield was 12.5 MT/acre from 124 acres; he has kept 36 acres corn to be harvested for grain.
- Land clearing and tile drainage on farms continued!
- Farmers continued to use multiple sources of N (urea, ESN and ammonium sulphate) for crop production. Farmers are also applying ESN in the seed row; a practice recommended by LUARS. One producer applied ESN in seed row in over 600 acres for spring wheat, canola, barley, and corn production! Research at LUARS has proved that use of multiple sources of N instead of its single source was conducive to high yields. Some farmers applied fungicides and plant growth regulators to their crops to maximize their economic yields.
- Inspired by research at TBARS/LUARS dairy farmers around Calgary continued to expand their acreage under MasterGraze corn. TBARS pioneered in research on MasterGraze corn that produces

8 MT dry matter yield/ha in 80 days. Its feeding to dairy cows improved milk yield by 3l/cow/day and butter fat yield from 3.93 % to 4.40 %.

- Richardson International Limited procured 7,736 MT grains/and seeds from local producers as at November 23, 2022 at a value of 3.1 million dollars from Thunder Bay and Rainy River Districts; more will be received before the year end because the farmers are still holding their produce, especially canola, which from Thunder Bay alone, as also mentioned earlier, is estimated to be more than \$1,275,000. I believe at least one more Grain Elevator procured grains from the area (volumes not known). This is in addition to some malting barley procured by the Canada Malting Company from our area.
- A record number of people (over 200) visited LUARS this year. Apart from participants in the annual summer tour and individuals visiting LUARS from time to time, people in groups (AALP, Open Doors Event from the City of Thunder Bay, Summer School BSc students from the Faculties of Natural Resources Management and Environmental Management, Lakehead University, and Biology and Science Students from the La Vérendrye High School Thunder Bay) visited LUARS to see and learn what research has been going on at LUARS.

Mélanie Opaski, a Teacher of the La Vérendrye High School Thunder Bay, in her email of September 29, 2022 thus wrote to Dr. Sahota, “*I thank you once again for the visit as it was very informative to our students, myself and the other teacher Jacqueline*”.

LUARS has become a valuable Learning Centre for the High School, undergraduate and graduate students from Thunder Bay!

It may be noteworthy that the crop varieties mentioned in this section were tested at and recommended by LUARS. Thunder Bay producers are continuing to renovate, expand/or make additions to their fields and dairy operations! Jonathan and James Bakker put up a new Robot Milk Barn this year!

**Dr. Tarlok Singh Sahota CCA
Director LUARS Thunder Bay**

November 28, 2022