2. Summary of Research Results 2024

While we had good rainfall in May (74.8 mm), June (112.2 mm) and July (51.0 mm), which was good for vegetative growth and tillering/or branching, rain fall during grain development and ripening (30.7 mm in August and 11 mm in September) was too low! Plenty rain in June didn't allow the roots to go deeper, as a result of which the roots couldn't tap soil moisture from the deeper soil layers during the dry months of August and September. Consequently, the grain and seeds yield in cereals, soybean and canola suffered; not only at LUARS but at farmers' fields too. Spring wheat was affected more than the spring barley. GDD and CHU during May to September were 1,589 and 2,642, respectively – higher than that during the last year (1,511 and 2,513, respectively).

2.1 Screening of crop varieties:

2.1.1 Spring Cereals:

Barley Varieties:

- Eleven barley varieties were compared for their production potential.
- *AAC Cranbrook* (5.45 MT/ha), *Esma* (5.42 MT/ha) and *Synasolis* (4.97 MT/ha) were the three top grain yielding varieties.
- *CDC Bow* (grain yield 4.25 MT/ha) had the highest straw yield (7.85 MT/ha). *AAC Bell* (7.09 MT/ha) was next best variety for straw production.
- Biomass yield was highest with *CDC Bow* (12.1 MT/ha); followed by *AAC Crankbrook* (11.4 MT/ha).
- Averaged over 2023-2024, out of 10 common varieties, *AAC Cranbrook* produced the highest grain yield (5.17 MT/ha) and PSL Kerns the highest straw (6.52 MT/ha) and biomass (11.0 MT/ha) yields.
- Averaged over 2021-2024, out of 5 common varieties (*AAC Bell*, *AB Cattlelac*, *Boroe*, *CDC Bow* and *Synasolis*) during all these years, *Synasolis* (4.91 MT/ha) and *Boroe* (4.89 MT/ha) recorded higher grain yield than the other varieties (4.11-4.41 MT/ha). Similar trend was observed in the straw and the biomass yields.
- Diseases (including FHB) pressure was negligible.
- Lodging score ranged from 0.5 in *Esma* to 5.0 in *CH1209-1*.
- *AAC Cranbrook, Esma* and *Synasolis could be recommended for cultivation on farms.*

Malting Barley Varieties:

- Thirteen varieties were evaluated for grain and straw production. *AB Dram* and BC100 were the new varieties.
- Three Californian varieties were the top grain yielding varieties; *UC Tahoe* (5.57 MT/ha), *UC Capay* (5.05 MT/ha) and and *Butta 12* (4.89 MT/ha). These three also recorded the highest 1000 kernel weight (72-74 g).
- *UC Tahoe* recorded the highest straw (7.39 MT/ha) and biomass (13.0 MT/ha) yields.
- Averaged over 2023-2024, *UC Capay* produced the highest grain (4.87 MT/ha), straw (6.32 MT/ha) and biomass (10.9 MT/ha) yields.
- Averaged over 2021-2024, *CDC Bow* registered the highest grain (5.04 MT/ha) and biomass (11.0 MT/ha) yields. Second best grain yield (4.56 MT/ha) was obtained from *CDC Copper*. Straw yield was highest with *CDC Copper* (5.90 MT/ha), though only 0.02 MT/ha higher than that from *CDC Bow*.
- There was no lodging in any of the varieties, and the disease pressure, especially that of FHB was negligible.
- *Since the Californian varieties and CDC Bow seeds aren't available in Canada, CDC Copper could be recommended for cultivation on farms.*

New Canadian Western Red Spring (CWRS) Wheat Varieties:

- Eight CWRS wheat varieties were evaluated for their production potential.

- *AAC Westking*, a new variety, gave the highest grain yield (5.38 MT/ha) followed closely by *Brandon* (5.32 MT/ha). Grain yield of *AAC Wheatland VB* was 5.08 MT/ha. *AAC Westking* and *Brandon* equaled in the straw (8.39/8.43 MT/ha) and the biomass (13.8/13.7 MT/ha) yields. Diseases, including FHB, pressure in all the varieties was very low.
- Averaged over 2022-2024, out of the five varieties (*AAC Wheatland*, *Brandon*, *Rednet*, *AAC Redberry* and *AAC Leroy*) that were common during 2022-2024, *AAC Wheatland* produced the highest grain (4.18 MT/ha) and biomass (10.1 MT/ha) yields, whereas *Rednet* gave the highest straw yield (6.20 MT/ha).
- *Area producers could grow AAC Westking, Brandon and AAC Wheatland VB.*

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.
- Among the three varieties, *Rednet* recorded the lowest grain (3.38 MT/ha) yield. Grain yields of *Brandon* and *AAC Wheatland* were 4.24 and 4.13 MT/ha, respectively. Mixed cultivation of these varieties didn't increase the grain yields as compared to their pure/single cultivation.
- *Rednet* gave the highest straw (9.41 MT/ha) and Brandon 50% + AAC Wheatland 25% + Rednet 25% blend of the three varieties the highest biomass (13.2 MT/ha) yield.
- Averaged over 2022-2024, *Brandon* produced the highest grain yield (3.80 MT/ha). Whereas, highest straw (7.41 MT/ha) and biomass (10.30 MT/ha) yields were obtained with *Rednet*.
- *Mixed cultivation of wheat varieties isn't recommended!*

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.
- Three varieties that gave more than 7 MT/ha grain yield were *AAC Kongsore* (7.99 MT/ha), *Akina* (7.57 MT/ha) and *AAC Excellence* (7.17 MT/ha). Grain yield from *AC Rigodon*, an old timer good performer, was 6.21 MT/ha.
- *AAC Reid* recorded the highest straw (6.63 MT/ha) and the biomass (13.5 MT/ha) yields. Though the biomass yield (13.4 MT/ha) from *AAC Kongsore* equaled that from *AAC Reid*.
- None of the varieties lodged. *BYDV* score was the lowest (3.8) in *AAC Kongsore*.
- Averaged over 2023-2024, *AAC Kongsore* gave the highest grain yield (6.63 MT/ha) and *AAC Reid* the highest straw (5.97 MT/ha) and biomass (11.0 MT/ha) yields.
- Averaged over 2021-2024, among the four varieties (*AAC Douglas*, *AC Rigodon*, *Akina* and *CDC Endure*) common during these years, *Akina* recorded the highest grain (5.04 MT/ha), straw (5.28 MT/ha) and biomass (9.62 MT/ha) yields.
- *Oat growers could try growing AAC Kongsore* and *Akina for grain production and AAC Reid for straw/and forage production!*

2.1.2 Winter Cereals:

Winter Wheat Varieties:

- Nine winter wheat varieties were compared for their production potential including two new varieties *AAC Overdrive* and *AAC Network*.
- *CDC Falcon*, an oldest variety, produced the highest grain yield (6.24 MT) followed by *AAC Coldfront* (5.71 MT/ha) and *AAC Overdrive* (5.20 MT/ha).
- Straw yield was highest with *AAC Vortex* (10.3 MT/ha) and *CDC Falcon* (10.1 MT/ha). Straw yields of *AAC Coldfront* and *AAC Gateway* were 9.42 MT/ha and 9.00 MT/ha, respectively.
- Plant height didn't vary significantly with the varieties and ranged from 84 cm to 88 cm (*AAC Vortex*/and *Lexington*.
- Averaged over 2021, 2023 and 2024, among five varieties (*CDC Falcon*, *AAC Gateway*, *Lexington*, *PRO 81* and *Adrianus*) that were common during all these years, *CDC Falcon* recorded the highest

grain (6.11 MT/ha) and straw (8.45 MT/ha) yields. *AAC Gateway* equaled *CDC Falcon* in biomass yield (14.6 MT/ha).

Winter Barley Varieties:

- Five winter barley varieties (*McGregor*, *McKeller*, *Scala, LCS Calypso and SU Ruzena*) were tested for their winter survival and yield.
- Unfortunately, none of the varieties survived 2023-2024 winter.

Winter Rye Varieties:

- Five winter rye varieties were compared for their production potential including a relatively new variety *KWS Serafino*.
- *Brasetto* recorded the lowest (6.81 MT/ha) and *KWS Serafino* the highest (8.77 MT/ha) grain yield. Straw yield was highest with *Guttino* (9.94 MT/ha) and *KWS Serafino* (9.92 MT/ha). However, the grain and straw yield differences between the varieties were not significant.
- *Bono* produced the tallest (138 cm) and *Hazlet* the shortest plants (129 cm).
- Averaged over 2023-2024, grain yield ranged from 7.03 MT/ha in *Bono* to 8.24 MT/ha in *KWS Serafino*. *Hazlet* recorded the highest straw yield (10.67 MT/ha). Straw yield in other varieties ranged from 8.73 MT/ha in *Bono* to 9.74 MT/ha with *Brasetto*.
- *Considering the both grain and the straw yields, KWS Serafino can be recommended for cultivation on farms!*

2.1.3 Grain Legumes and Oil Seeds Varieties:

Soybean Varieties (Seeded on May 28, 2024):

- Twenty varieties were compared for their grain production potential.
- Three top grain yielding varieties were *NSC Culross RR2X* (3.88 MT/ha), *EXP008-23XF* (3.77 MT/ha) and *S007-A2XS* (3.70 MT/ha).
- *NSC Culross RR2X* gave the highest straw (3.97 MT/ha) and biomass (7.85 MT/ha) yields, closely followed by *S007-A2XS* and EXP008-23XF.
- *NSC Culross RR2X*, *EXP008-23XF* and *S007-A2XS could be recommended for cultivation on farms!*

Linseed Flax Varieties (Seeded on May 21, 2024):

- Twelve varieties of linseed flax, including two new varieties, *CDC* Esma and *AAC Kernen*, were compared for their production potential.
- Three top seed yielding varieties were *CDC Esma* (4.43 MT/ha), *CDC Sorrel* (4.19 MT/ha) and *CDC Dorado* (4.08 MT/ha).
- Straw yield (2.92 MT/ha) was highest with *CDC Neela* and biomass (7.22 MT/ha) yield was the highest with *CDC Esma*.
- *CDC Esma, CDC Sorrel and CDC Dorado could be recommended for cultivation on farms.*

Winter Canola Varieties:

- Two winter canola varieties, *Mercedes* and *Inspiration*, were tested for their winter survival and production potential.
- Neither *Mercedes* nor *Inspiration* survived 2023-2024 winter.

Liberty Canola Varieties (Seeded on May 10, 2024):

- Twelve varieties were evaluated; some of them new and more than half of which had Clubroot resistance/or shatter reduction trait. *P stands for 'Shatter Reduction' and C for 'Clubroot Resistance'.*
- Three top seed yielding varieties were *InVigor® L340PC* (4.98 MT/ha), *DKLL-82SC* (4.91 MT/ha) and *InVigor® L350PC* (4.84 MT/ha). Two top straw yielding varieties were *InVigor® L340PC* (9.93 MT/ha), and *InVigor® L350PC* (9.25 MT/ha).
- Biomass yield was highest with *InVigor® L340PC* (14.9 MT/ha), *InVigor® L350PC* (14.1 MT/ha) and *DKLL-82SC* (13.0 MT/ha).

- Averaged over 2022-2023, seed yields were in the order of *P501L* (4.09 MT/ha) ≥ *DKLL-82SC* (3.84 MT/ha).
- *Area growers could try cultivating InVigor® L340PC, DKLL-82SC* and *InVigor® L350PC on their farms in 2025!*

Roundup Ready Canola Varieties (Seeded on May 16, 2023):

- Fifteen varieties were compared for their production potential. *CR stands for Clubroot resistance, TF for Truflex and SC stands for straight cut.*
- *DK902TF* gave the highest seed yield (5.79 MT/ha). The next two best varieties in seed yield were *DK900TF* (5.37 MT/ha) and *DK903TF* (5.33 MT/ha).
- *CS3100 TF*, *BY6076CR* and DK900TF produced 8 MT/ha or more than 8 MT/ha straw yield.
- Averaged over 2022-2024, out of six varieties that were common during these years, *BY6204TF* gave the highest seed yield (4.19 MT/ha). Whereas, BY6076CR gave the highest straw (9.47 MT/ha) and biomass (13.1 MT/ha) yields.
- *Farmers, if they decide to grow RR canola, could prefer DK902TF for cultivation on their farms.*

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

- Six varieties were compared for their production potential.
- Highest seed yield (4.81 MT/ha) was obtained with *5545CL*.
- Straw (8.26 MT/ha) and biomass (12.0 MT/ha) yields were highest with *CS2800CL*.
- Averaged over 2021-2024, *5545CL* produced the highest seed (3.85 MT/ha) and biomass (10.1 MT/ha) yields, and *CS2700CL* the highest straw yield (7.18 MT/ha).

2.1.4 Forage Crops/Varieties:

Spring Barley Varieties for Forage Production:

- Eleven varieties were evaluated for forage production.
- Highest forage dry matter yield was registered by *CDC Bow* (21.1 MT/ha; 8.5 % protein). Next two best yielding varieties were *AAC Crankbrook* (19.7 MT/ha; 8.2 % protein) and *CH1209-1* (19.4 MT/ha; 11.0 % protein). *AAC Sorel* had the highest protein content - 11.2 %) but its dry matter yield was relatively lower (17.1 MT/ha).
- RFV was highest in *Esma/and CH1209-1* (136) followed by *Synasolis* (128).
- Averaged over 2021-2024, dry matter yield ranged from 10.9 MT/ha with *AB Cattelac* to 11.9 MT/ha with *Boroe*. *AB Cattelac* (10.7 %) and *Synasolis* (10.5 %) were the best varieties for protein content. Dry matter yield with *Synasolis* (11.0 MT/ha) was next best to *Boroe* (11.9 MT/ha) and *CDC Bow* (11.6 MT/ha). RFV was the highest in *AB Cattelac* (129) followed by *Synasolis* (118).
- *Considering the dry matter yield, protein content and RFV, Boroe*, *CDC Bow*, *Synasolis and CH1209-1 can be recommended for forage production!*

Malting Barley Varieties for Forage Production:

- Thirteen varieties were evaluated for forage production.
- Highest forage dry matter yield (21.0 MT/ha) was obtained with *UC Tahoe*. Two next best varieties for forage production were *CDC Bow* (17.8 MT/ha) and *CDC Copper* (16.5 MT/ha).
- Averaged over 2022-2024, *CDC Copper* (12.7 MT/ha), UC Tahoe (12.6 MT/ha) and *CDC Bow* (12.2 MT/ha) produced the highest forage dry matter yields.
- *Butta 12* (12.8 %), *CDC Copper* (12.2 %) and AB Dram (11.9 %) had higher protein content than the other varieties (7.8 % to 9.4 %). *AAC Prairie* had the highest RFV (148).
- Averaged over 2022-2024, *Butta 12* (13.2 %), *CDC Copper* (10.8 %) and *AAC Goldman* (10.5 %), had higher protein content than the other varieties (8.7 % to 9.9 %). *UC Capay* had the highest RFV (147).
- *Considering the dry matter yield and protein content over three years, 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 2021): Two cuts were taken!

- Six alfalfa varieties were compared for their forage yield and quality.
- *Revolution MD* gave the highest (5,798 kg/ha) and *135* (4,389 kg/ha) the lowest dry matter yield.
- Protein content in the first cut ranged from 19.4 % in *SW 4107* to 25.3 % in *Evermost*.
- Protein content in the second cut varied from 18.4 % in *SW 4107/and 135* to 21.0 % in *Dynasty*.
- *Evermost* had the highest RFV (113) in the first cut and *Shockwave BR* had the highest RFV (148) in the second cut.
- Averaged over 2022 to 2024, *Revolution MD* gave the highest dry matter yield (5,547 kg/ha), followed by *SW 4107* (5,174 kg/ha) and *Shockwave BR* (5,072 kg/ha). First cut protein content ranged from 20.5 % in *Shockwave BR* to 22.2 % in *Evermost*. In the second cut, *Dynasty* gave the highest (22.2 %) and *135* the lowest (20.5 %) protein content. Protein yield was the highest (1,176 kg/ha) with *Revolution MD*. RFV was the highest (134) in *Evermost* in the first cut and *Shockwave BR* had the highest RFV (135) in the second cut.
- *Considering both the dry matter yield and the protein yield, Revolution MD could be recommended for cultivation on farms!*

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

- Averaged over 2012-2024, *Galega* gave 836 kg/ha higher dry matter yield than *alfalfa*, which was more grass than alfalfa. Alfalfa stand had become scanty over the years.
- *Galega* had ~6 % point higher protein content than *alfalfa* in the first cut and 4.5 % point higher protein content in the second cut.
- RFV was a bit higher in *alfalfa* (101) than in *Galega* (96) in the first cut, whereas in the second cut RFV was more or less the same in *alfalfa* (120) and *Galega* (119).
- Mineral (copper, zinc, iron and manganese) content was higher in *Galega* than in *alfalfa* in both the cuts.
- *Higher yield and higher protein content in Galega than in alfalfa, could make Galega a better fodder choice than alfalfa!*

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

- *Galega*, *sainfoin*, *alfalfa*, *Trefoil* and *red clover* were compared for their production potential and forage quality. *Sainfoin* and *Red Clover* didn't survive after 2021.
- Dry matter yields from *Galega*, *alfalfa* and *Trefoil* in 2024 were 7,202, 6,774 and 4,696 kg/ha, respectively. Corresponding values for average dry matter yield for 2021 to 2024 were 5,027, 5,672 and 4,494 kg/ha.
- In 2024, the first cut, protein content was in the order of *alfalfa* (25.4 %) > *Galega* (24.8 %) > *Trefoil* (22.1 %) and the second cut protein content was in the order of *Galega* (21.7) > alfalfa (20.8 %) > *Trefoil* (19.0 %).
- Averaged over 2021 to 2024, *Galega* and *Trefoil* equaled in protein content (22.3 %) in the first cut, which was 1.5 % point higher than the protein content in *alfalfa*. Second cut protein content was in the order of Galega (22.9 %) > *Trefoil* (21.9 %) > *alfalfa* (20.1 %).
- In 2024, *Galega* had the highest RFV in the first (114) as well as in the 2nd cut (151). Averaged over 2021 to 2024, *Trefoil* had the highest RFV in the first (135) as well as in the 2nd cut (141).

Corn Silage Varieties:

- Thirteen silage corn varieties were evaluated for their forage production potential.
- *MS 7420R* (19.3 MT/ha), *MS 8022R* (19.0 MT/ha) and *DKC29-89RIB* (17.8 MT/ha) recorded higher dry matter yield than the other varieties (13.0 – 16.2 MT/ha).
- Protein content was the highest (12.7 %) in *DKC24-06RIB*, which was 84 % higher than the highest yielding variety (*MS 7420R*) that had 6.9 % protein content. *X160470* had the highest RFV (119) – higher by 34 than that with the highest yielding variety (*MS 7420R*).
- Based on three years' (2021, 2023 and 2024) averages, *DKC29-89RIB* (18.2 MT/ha), and *DKC30-07RIB* (17.4 MT/ha) gave significantly higher dry matter yield than the other varieties.

- Averaged over three years (2021, 2023 and 2024), protein content ranged from 6.6 % in *DKC30-07RIB* to 8.9 % in *DKC24-06RIB*. *DKC29-89RIB* that had the highest dry matter yield had the highest RFV (150) as well.
- *Considering the yield from the three years, DKC29-89RIB and DKC30-07RIB could be recommended for cultivation on farms!*

Sorghum Sudangrass Varieties:

- Four *Sorghum Sudangrass* varieties were tested for their production potential.
- *SS2 BMR* registered the highest dry matter yield (8.14 MT/ha) followed by 7.83 MT/ha by *Summer Select* and 7.82 MT/ha by *Pacific Grage Brand Hybrid*. Dry matter yield with *BMR* was 7.55 MT/ha. However, the yield differences between the four varieties were not significant.
- In the first cut, *SS2 BMR* recorded the highest (16.3 %) and *BMR* the lowest (13.8 %) protein content. In the second cut, *BMR* had the highest (24.2 %) and *SS2 BMR* had the lowest (16.6 %) protein content.
- In the first cut, RFV was the highest (88) in *SS2 BMR*, whereas *BMR* had the highest (154) RFV in the second cut.
- Averaged over the two years (2023 and 2024) *SS2 BMR* produced the highest dry matter yield (9.47 MT/ha); the yield in other varieties ranged from 8.18 MT/ha to 8.33 MT/ha.
- Based on the average of the two years, *SS2 BMR* had the highest protein content (17.0 %) in the first cut and *BMR* had the highest protein content (20.4 %) in the second cut. *BMR* had the highest RFV in the first (114) as well as in the second (129) cut.
- *Considering the total dry matter yield, protein content in the first cut and RFV in both the cuts, SS2 BMR can be recommended for cultivation on farms!*

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 3,261 kg/ha with *1615 GrazeMaster – HQ* to 5,471 kg/ha with *NirtoMaster – SA + Barricade –* a different trend from last years. Two next best treatments, were *NitroMaster – V + Barricade* (5,401 kg/ha) and *Grazing Alfalfa + Sainfoin* (5,272kg/ha).
- *AC Langille Trefoil* and *Grazing Alfalfa + Sainfoin* had the highest protein content in the first cut (25.3 %). In the second cut *NitroMaster – V + Barricade* had the highest protein content (21.2 %) followed by *Grazing Alfalfa* (19.8 %) and *AC Langille Trefoil* (19.7 %).
- *AAC Sainfoin*, *1615 GrazeMaster – HQ* and *AC Langille Trefoil* had the highest RFV (102-104) in the first cut. Whereas, in the second cut, *AC Langille Trefoil* and *NitroMaster – V + Barricade* had the highest RFV (148/147).
- Averaged over 2022 to 2024, 75% *Grazing Alfalfa* + 25% *AAC Sainfoin* produced the highest dry matter yield (5,061 kg/ha). *AC Langille Trefoil* recorded the highest protein content in the first (23.0 %) as well as in the second cut (22.9 %). 75% *Grazing Alfalfa* + 25% *AAC Sainfoin* had 20.7 % protein content in the first cut and 21.4 % protein content in the second cut. *AC Langille Trefoil* produced the highest RFV in the first (122) as well as in the second cut (155).
- *Considering the dry matter yield, combined cultivation of alfalfa and sainfoin could be recommended!*

Evaluation of Combined Cultivation of Sorghum Sudangrass and Alfalfa (Seeded in 2023): Two cuts were taken.

- Maximum dry matter yield (5,590 kg/ha) was obtained with sorghum Sudangrass seeded @ 50 % seed rate + alfalfa @ 100 % seed rate when two cuts were taken in the seeding year too.
- Two next best treatments were seeding alfalfa alone @ 100 % seeding rate and taking one cut in the seeding year (5,217 kg/ha) and seeding alfalfa alone @ 100 % seeding rate and taking no cut in the seeding year (5,183 kg/ha).
- Seeding both sorghum Sudangrass and alfalfa together @ 100 % seed rate each recorded the minimum dry matter yield (3,779 kg/ha).
- Protein content in the first cut was highest with seeding sorghum Sudangrass @ 50 % seeding rate and alfalfa @ 100 % seeding rate with one cutting in the seeding year (16.2 %)/and with seeding sorghum Sudangrass @ 75 % seeding rate and alfalfa @ 125 % seeding rate with two cuttings in the seeding year (16.2 %). Alfalfa seeded @ 100 % seeding rate with no cuts in the seeding year had 15.9 % protein content in the first cut. RFV in the first cut was the highest (123) with seeding sorghum Sudangrass @ 50 % seeding rate and alfalfa @ 125 % seeding rate with one cutting in the seeding year
- Maximum protein content (20.9 %) in the second cut was obtained with seeding sorghum Sudangrass @ 50 % seeding rate and alfalfa @ 100 % seeding rate with one cutting in the seeding year. Alfalfa alone seeded @ 125 % seeding rate with no cut in the seeding year had 19.9 % protein content and alfalfa seeded @ 100 % seeding rate with one cut in the seeding year had 19.2 % protein content. RFV in the second cut was the highest (148) with seeding sorghum Sudangrass @ 50 % seeding rate and alfalfa @ 100 % seeding rate with one cutting in the seeding year.
- *Considering both the yield and quality parameters, seeding sorghum Sudangrass @ 50 % seeding rate and alfalfa @ 100 % seeding rate could be recommended with one cut in the seeding year!*

Evaluation of Combined Cultivation of Sorghum Sudangrass and Alfalfa (2024 Seeded):

- Only one cut could be taken.
- Sorghum Sudangrass seeded @ 75% seeding rate + Alfalfa seeded @ 100% seeding rate recorded the highest dry matter yield (3,499 kg/ha), followed closely by Sorghum Sudangrass seeded @ 50% seeding rate + Alfalfa seeded @ 100% seeding rate (3,338 kg/ha).
- Alfalfa seeded @ 100 % seeding rate had the highest protein content (16.7 %). Sorghum Sudangrass seeded @ 100 % seeding rate + Alfalfa seeded @ 125 % seeding rate had the second highest protein content (15.3 %).

Sorghum Sudangrass Seeding Rate Effects on Alfalfa and Canola as Subsequent Crops:

- This year, *Corn* and *Barley* at recommended seed rates were compared with *Sorghum Sudangrass* @ 45 kg/ha, 70 kg/ha, 80 kg/ha and 90 kg/ha seeding rates for forage production. Effect of these crops on canola and alfalfa will be studied next year!
- Forage dry matter yield was in the order of *Barley* (9.27 MT/ha) > *Corn* (6.35 MT/ha) > *Sorghum Sudangrass* @ 70 kg seed/ha (5.02 MT/ha). All other seeding rates of *Sorghum Sudangrass* produced lower dry matter yield than *Sorghum Sudangrass* seeded @ 70 kg seed/ha.
- *Sorghum Sudangrass* @ 45 kg seed/ha had the highest protein content (15.4 %). Protein content in *Barley was* 6.6 % and in *Corn* it was 5.9 %.
- The soil in this plot range wasn't too healthy/retentive of soil water; hence the dry matter yield and protein content in *Corn* were low.

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

2.2.1 Spring Cereals:

Effect of Seeding Dates, Rates of Nitrogen and Manipulator on Spring Wheat (AAC Wheatland):

- Pre-Seeding Soil Test indicated Nitrate N: 30 ppm, and Ammoniacal N:14 ppm.
- Treatments included all combinations of four seeding dates (May 8 to May 30 at weekly intervals, except where weather didn't permit to keep that interval), two N rates (80 and 160 kg N/ha) and two levels of Manipulator (no Manipulator spray and Manipulator spray @1.8 l/ha at tillering).

- Maximum grain (4.64 MT/ha) yield was obtained with seeding on May 8, application of N @ 80 kg/ha and no Manipulator spray. While maximum straw (6.50 MT/ha) and biomass (10.50 MT/ha) yields were recorded with May 30 seeding supplied with 80 kg N/ha and sprayed with Manipulator.
- Averaged over N rates and Manipulator treatments, May 8 seeding produced the highest grain yield (4.55 MT/ha). Straw (6.13 MT/ha) and biomass (10.1 MT/ha) yields were highest with May 30 seeding.
- Averaged over seeding dates and Manipulator treatments, increasing N rate from 80 to 160 kg/ha didn't significantly improve the grain yield, though it increased the straw yield from 5.21 MT/ha to 5.74 MT/ha and biomass yield from 9.20 MT/ha to 9.80 MT/ha.
- Averaged over seeding dates and N rates, Manipulator spray didn't increase the grain, straw or biomass yields, though it reduced the plant height by 4 cm.
- Averaged over 2021, 2023 and 2024, maximum grain (4.33 MT/ha) and biomass (9.2 MT/ha) yields were recorded with seeding on May 8, application of N @ 80 kg/ha and no Manipulator spray. Whereas, maximum straw yield was registered by May 30 seeding, application of 160 kg N/ha and spray of Manipulator.
- *The results over three years indicated that wheat should be seeded as soon as possible in the spring, 80 kg N/ha was sufficient for wheat production and no Manipulator spray was required for a dwarf wheat variety such as AAC Wheatland.*

Effect of Seeding Dates, Rates of Nitrogen and Manipulator on Spring Barley (Synasolis):

- Pre-Seeding Soil Test indicated Nitrate N: 30 ppm, and Ammoniacal N:14 ppm.
- Treatments included all combinations of four seeding dates (May 8 to May 30 at weekly intervals, except where weather didn't permit to keep that interval), two N rates (80 and 160 kg N/ha) and two levels of Manipulator (no Manipulator spray and Manipulator spray @ 2.3 l/ha at tillering).
- Maximum grain yield (6.64 MT/ha) was recorded with seeding on May 15, application of N @ 80 kg N/ha and no Manipulator spray and (6.63 MT/ha).
- Straw (7.70 MT/ha) yield was the highest with seeding on May 24, supplied with N @ 160 kg/ha without spraying Manipulator. Biomass yield (13.7 MT/ha) in this treatment equaled that from May 24 seeding with 160 kg N/ha and Manipulator spray (13.8 MT/ha).
- Averaged over seeding dates and Manipulator treatments, increasing the rate of N application from 80 to 160 kg N/ha didn't increase the grain yield. but significantly improved the straw yield.
- Averaged over seeding dates and N rates, grain, straw or biomass yields were not affected by *Manipulator* spray.
- Averaged over 2021, 2023 and 2024, grain yields were maximum with May 8 (5.19 MT/ha) or May 15 (5.18 MT/ha) seedings. However, the straw (5.72/5.65 MT/ha) and biomass (10.2/10.4 MT/ha) yields were higher with the later seedings. Increasing the rate of N application from 80 to 160 kg N/ha significantly improved the straw yield, but not the grain and biomass yields. *Manipulator* spray had no impact on grain, straw or biomass yields.
- Disease ratings of different diseases, on the scale of 0-9, were very low (0.31-1.41) except for BYDV (7.0-7.8).
- *Farmers should try to seed barley by May 15, apply 80 kg N/ha. Manipulator spray should be done only if there is a risk of lodging. Lodging risk increases with late seeding and at increased rate of N (160 kg N/ha).*

Evaluation of Urea, ESN, Urea Super^{U}, Their Blends, and Urea Treated with Anvol for production of Spring Wheat:

- Urea, ESN and Urea Super^{U}, their blends and Anvol treated urea were compared @ 80 and 120 kg N/ha – all applied at seeding. A no N check treatment was also kept.
- Application of N at either of the rates or sources of N except the Anvol treated urea significantly increased the grain, straw and biomass yields.

- At 80 kg N/ha, best treatment was application of two third N from urea and one third from ESN that gave 4.83 MT/ha grain yield, 5.40 MT/ha straw yield and 10.22 MT/ha biomass yield.
- At 120 kg N/ha, best treatment was application of the entire amount of N as urea; at which the grain yield (5.00 MT/ha) was not significantly better than that with 80 kg N/ha – two third from urea and one third from ESN. Straw and biomass yields with urea @ 120 kg N/ha were 6.58 MT/ha and 11.58 MT/ha, respectively.
- Averaged over N sources, 120 kg N/ha didn't give significantly higher grain, straw or biomass yield than that with 80 kg N/ha.
- Averaged over 2022 and 2024, treatments' effect was similar to that in 2024.

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):

- In both wheat and barley, 80 kg N/ha with *Manipulator* spray tended to outyield other treatments. Grain yields in wheat and barley with this treatment were 5.19 MT/ha and 6.59 MT/ha.
- Straw (6.83 MT/ha) and biomass (11.5 MT/ha) yields in wheat were highest with 160 kg N/ha without spraying *Moddus* or *Manipulator*. This was more or less true for barley too (straw yield 6.08 MT/ha and biomass yield 12.1 MT/ha).
- Averaged over N rates and *Manipulator*/*Modus* treatments, barley outyielded wheat by 1.43 MT/ha in grains and 1.20 MT/ha in biomass yield.
- Averaged over crops and *Manipulator*/*Modus* treatments, grain, straw and biomass yields were similar at 80 and 160 kg N/ha.
- Averaged over crops and N rates, *Manipulator* gave somewhat (0.16 MT/ha) higher grain yield than *Modus*. Straw and biomass yields with the two *PGRs* were similar.
- Averaged over years (2021-2024), N rates and *Manipulator*/*Modus* treatments, barley produced significantly higher grain, straw and biomass yields than wheat.
- Averaged over years (2021-2024), crops and *Manipulator*/*Modus* treatments, there was no difference between the grain, straw and biomass yields at the two rates of N (80 and 160 kg N/ha).
- Averaged over years (2021-2024), crops and N rates, *Manipulator*/or *Modus* spray didn't affect the grain, straw or biomass yields.
- *Because of the exceptionally dry weather in August and September this year, there was no significant response to Moddus/*or *Manipulator* spray and 160 kg N/ha didn't do better than 80 kg N/ha*. Barley could be preferred to wheat in a dry year. However, the question is how to know that the year is going to be dry?*

Evaluation of Utrisha^{TM} N For Spring Wheat Production:

- *Utrisha^{TM} N* @ 333 g/ha applied at 4 leaf stage was tested at 3 rates of N (0, 45 and 90 kg N/ha) for spring wheat production.
- Grain, straw and biomass yields increased with the increasing rates of N from 0 to 45 to 90 kg N/ha; grain yield from 2.87 to 4.10 MT/ha without *Utrisha^{TM} N* and from 2.77 to 4.31 MT/ha with *Utrisha^{TM} N*, straw yield from 4.05 to 6.17 MT/ha without *Utrisha^{TM} N* and from 4.16 to 6.07 MT/ha with *Utrisha^{TM} N* and biomass yield from 6.80 to 10.11 MT/ha without *Utrisha^{TM} N* and from 6.82 to 10.21 MT/ha with *Utrisha^{TM} N.*
- Averaged over N rates, *Utrisha^{TM} N* appeared to increase the grain, straw and biomass yields, though the increases were non-significant.
- Averaged over *Utrisha^{TM} N*, increasing the N rate from 0 to 90 kg N/ha increased the grain yield from 2.82 to 4.21 MT/ha, straw yield from 4.11 to 6.12 MT/ha and biomass yield from 6.81 to 10.16 MT/ha; though the responses followed the Law of Diminishing Returns.
- Averaged over 2023-2024 and N rates, *Utrisha^{TM} N* didn't significantly affect the grain, straw and biomass yields.

- Averaged over 2023-2024 and *Utrisha^{TM} N*, increasing the N rate from 0 to 90 kg N/ha increased the grain yield from 2.68 to 3.48 MT/ha, straw yield from 3.63 to 4.81 MT/ha and biomass yield from 5.95 to 7.87 MT/ha, and the responses followed the Law of Diminishing Returns.
- *We will repeat the experiment in the next year.*

Residual Effect of MAP + MST Applied to Canola (2023) on Spring Wheat (2024):

- All treatments, irrespective of the sulphur (S) source increased the grain yield as compared to the check (no S). However, only ammonium sulphate applied @ 36 kg S/ha improved the grain yield significantly (by 1.07 MT/ha over the check treatment). Similar trend was observed in the biomass yield, though straw yield wasn't significantly affected by the treatments.
- Averaged over S sources, S @ 36 kg S/ha significantly improved the grain (by 0.72 MT/ha) and biomass (by 1.4 MT/ha) yields.
- Among the sources/and blends of S sources, ammonium sulphate gave the highest grain (5.83 MT/ha) and biomass (13.2 MT/ha) yields.
- Averaged over 2023 and 2024 and S, ammonium sulphate increased the grain, straw and biomass yields as compared to the check (no S), but not significantly.

Residual Effect of SymTrx Applied to Canola (2023) on Spring Wheat (2024):

- Grain yield was not affected by the treatments - S applied to canola last year through *SymTrx* or *ammonium sulphate* or from blends of the two fertilizers. Straw (9.21 MT/ha) and biomass (13.5 MT/ha) yields were maximum with 12 kg S/ha from ammonium sulphate and 24 kg S/ha from SymTrx.
- Averaged over 2023 and 2024, grain, straw and biomass yields were unaffected by the treatments (ammonium sulphate or SymTrx or the blends of the two fertilizers).

2.2.2 Winter Cereals:

Evaluation of Urea, ESN, Urea Super^{U}, Their Blends, and Urea Treated with Anvol for production of Winter Wheat:

- Urea, ESN and Urea Super^{U}, their blends and Anvol treated urea were compared at 120 kg N/ha – all applied at seeding. A no N check, split application of urea (30 kg N/ha at seeding and 90 kg N/ha in spring), urea Super^{U} @ 100 kg N/ha and urea @ 160 kg N/ha all applied at seeding were also kept as additional checks.
- Pre-Seeding Soil Test in this experiment was Nitrate N: 6 ppm, Ammoniacal N: 8 ppm.
- Application of urea @ 60 kg N/ha + ESN @ 60 kg N/ha at seeding gave the highest grain (7.87 MT/ha), straw (12.5 MT/ha) and biomass (20.3 MT/ha) yields.
- Next best grain (6.17 MT/ha), straw (10.3 MT/ha) and biomass (16.5 MT/ha) yields were obtained with the application of urea @ 60 kg N/ha + Urea Super^{U} @ 60 kg N/ha at seeding.
- Grain and straw yield in no N check were 5.27 MT/ha and 9.09 MT/ha and that with Urea @ 30 kg N/ha at seeding and Urea @ 90 kg N/ha in spring were 5.49 MT/ha and 9.53 MT/ha, respectively, which were no better than the no N check.
- Averaged over 2023 and 2024, application of urea @ 60 kg N/ha + ESN @ 60 kg N/ha at seeding gave the highest grain (6.77 MT/ha), straw (11.8 MT/ha) and biomass (18.3 MT/ha) yields.

Comparative Performance of Urea, ESN, Puryield, and Their Blends in Winter Wheat: Urea, ESN, PurYield and their blends were compared @ 120 kg N/ha.

- Maximum grain yield (6.76 MT/ha) was obtained with urea @ 120 kg N/ha/and with the combined application of urea and PurYield each @ 60 kg N/ha.
- Straw (11.4 MT/ha) and biomass (18.2 MT/ha) yields were the highest with urea @ 120 kg N/ha.
- Grain, straw and biomass yields from PurYield @ 120 kg N/ha were 6.05 MT/ha, 9.69 MT/ha and 15.8 MT/ha, respectively (straw and biomass yields were second best to urea @ 120 kg N/ha).

- Straw and biomass yields from the combined application of urea and PurYield each @ 60 kg N/ha were 9.10 MT/ha and 15.9 MT/ha, respectively.
- Grain (4.89 MT/ha), straw (8.82 MT/ha) and biomass (13.7 MT/ha) yields from ESN @ 120 kg N/ha were lower than that from PurYield at the same rate of N.

2.2.3 Canola:

Response of Canola (DKTF93SC) to High Rates of N Application from Different Sources:

- Application of N @ 90, 180, 240 and 360 kg/ha from urea, urea + ESN (2:1 ratio on N basis), urea super^{U} (USU), urea + urea super^{U} (2:1 ratio on N basis) and urea + ESN + urea super^{U} each @ 60 kg N/ha (total 180 kg N/ha) significantly improved the canola seed yield as compared to the check (no N).
- Three top seed yielding treatments were Urea @ 240 kg N/ha + ESN @ 120 kg N/ha (5.40 MT/ha), USU @ 360 kg N/ha (5.30 MT/ha) and USU @ 270 kg N/ha (5.17 MT/ha).
- Highest straw (8.63 MT/ha) and biomass (13.8 MT/ha) yields were obtained with USU @ 270 kg N/ha, followed closely by USU @ 360 kg N/ha (straw yield 8.19 MT/ha and biomass yield 13.5 MT/ha). Straw and biomass yields with Urea @ 240 kg N/ha + ESN @ 120 kg N/ha were 7.96 MT/ha and 13.4 MT/ha, respectively.
- Averaged over N sources, seed (5.21 MT/ha), straw (7.86 MT/ha) and biomass (13.1 MT/ha) yields were maximum at 360 kg N/ha.
- Averaged over N rates, seed, straw and biomass yield differences between the sources and blends of N were not significant.
- Averaged over years (2020, ’21, ’23 and ‘24), Urea @ 240 kg N/ha + USU @ 120 kg N/ha (4.34 MT/ha), USU @ 360 kg N/ha (4.26 MT/ha) and Urea @ 180 kg N/ha + ESN @ 90 kg N/ha/or Urea @ 270 kg N/ha (4.09 MT/ha) gave higher seed yield than the other treatments. Highest straw yield (7.64 MT/ha) was obtained with Urea @ 270 kg N/ha followed closely by USU @ 360 kg N/ha (7.55 MT/ha).
- Averaged over years and N sources/blends, 270 kg N/ha (4.01 MT/ha) and 360 kg N/ha (4.07 MT/ha) produced higher seed yield than the lower rates of N (90 kg N/ha and 180 kg N/ha). However, straw yield was highest (7.24 MT/ha) with the application of 270 kg N/ha.
- Averaged over years and N rates, seed, straw and biomass yield differences between the sources and blends of N were not significant.
- *Considering both the seed and the straw yields, farmers could try application of N @ 270 kg N/ha; two third from urea and one third from ESN.*

Comparative Performance of Urea, ESN, PurYield and Their Blends in Canola:

- PurYield (45-0-0), a granular Enhanced Efficiency Fertilizer, consists of urea with an innovative pink proprietary polymer coating.
- All fertilizers and their blends were compared @ 180 kg N/ha with a check (No N treatment).
- Application of N @ 180 kg N/ha, on an average, increased the canola seed yield by 2.19 MT/ha, straw yield by 3.78 MT/ha and biomass yield by 6.0 MT/ha as compared to the check (No N).
- Highest seed yields were recorded with urea @ 120 kg N/ha + ESN @ 60 kg N/ha (4.87 MT/ha), urea @ 120 kg N/ha + PurYield @ 60 kg N/ha (4.80 MT/ha) and PurYield @ 180 kg N/ha (4.76 MT/ha). However, seed yield differences between different fertilizers or their blends were not significant.
- Highest straw (9.89 MT/ha) and biomass (14.8 MT/ha) yields were produced with urea @ 120 kg N/ha + ESN @ 60 kg N/ha, followed by PurYield @ 180 kg N/ha (straw 8.86 MT/ha; biomass 13.6 MT/ha).
- Averaged over 2023 and 2024, highest seed (4.45 MT/ha) and biomass (12.1 MT/ha) yields were obtained with Urea @ 120 kg N/ha + PurYield @ 60 kg N/ha. Highest straw yield (7.88 MT/ha) was registered with Urea @ 120 kg N/ha + ESN @ 60 kg N/ha. However, the yield differences between different fertilizers or their blends were not statistically significant.

- *Farmers can try replacing ESN with PurYield, if PurYield is less costly than ESN.*

Evaluation of MAP + MST as a Source of S for Canola Production:

- Maximum seed yield (4.48 MT/ha) was recorded with 36 kg S/ha; 12 kg S/ha from *ammonium sulphate* + 24 kg S/ha from *MAP + MST*. The next best seed yield (4.36 MT/ha) was obtained with 24 kg S/ha from *ammonium sulphate* + 12 kg S/ha from *MAP + MST*.
- Maximum straw (8.09 MT/ha) and biomass (12.60 MT/ha) yields were obtained with application of S @ 36 kg S/ha; 12 kg S/ha from *ammonium sulphate* + 24 kg S/ha from *MAP + MST*.
- Averaged over S sources, S @ 36 kg/ha significantly improved the seed yield by 2.16 MT/ha, straw yield by 2.06 MT/ha and biomass yield by 4.20 MT/ha.
- Averaged over S rates, maximum seed (4.26 MT/ha) straw (7.47 MT/ha) and biomass (11.7 MT/ha) yields were obtained with the combined application of *ammonium sulphate* and *MAP + MST*.
- Averaged over years (2021-2024), maximum seed yield (3.92 MT/ha) was recorded with 36 kg S/ha; 24 kg S/ha from *ammonium sulphate* + 12 kg S/ha from *MAP + MST*. However, maximum straw (7.67 MT/ha) and biomass (11.4 MT/ha) yields were recorded with S @ 36 kg S/ha; 12 kg S/ha from *ammonium sulphate* + 24 kg S/ha from *MAP + MST*.
- Averaged over years (2021-2024) and sources, 36 kg S/ha increased the seed, straw and biomass yields by 0.60, 1.37 and 2.0 MT/ha, respectively.
- Averaged over years (2021-2024) and S rates, combined application of *ammonium sulphate* and *MAP + MST* produced the maximum seed (3.86 MT/ha), straw (7.46 MT/ha) and biomass (11.2 MT/ha) yields.
- *S to canola could be applied @ 36 kg S/ha through blends of ammonium sulphate and MAP + MST!*

Residual Effect of MAP + MST as a Source of Sulphur on Canola after Canola-Wheat:

- Residual effect of S applied to canola in 2022, as *MAP + MST* or *ammonium sulphate* or their combinations, on third year canola after canola - wheat was significant i.e., S applied in 2022 improved the third year canola seed yield significantly by 0.85 to 2.65 MT/ha.
- Maximum seed yield (4.89 MT/ha) was recorded with 36 kg S/ha; 12 kg S/ha from *ammonium sulphate* + 24 kg S/ha from *MAP + MST*. The next best seed yield (4.63 MT/ha) was obtained with 24 kg S/ha from *ammonium sulphate* + 12 kg S/ha from *MAP + MST*.
- Maximum straw (8.65 MT/ha) and biomass (13.5 MT/ha) yields were obtained with application of S @ 36 kg S/ha; 12 kg S/ha from *ammonium sulphate* + 24 kg S/ha from *MAP + MST*.
- Averaged over S sources, S @ 36 kg/ha significantly improved the seed yield by 1.70 MT/ha, straw yield by 2.05 MT/ha and biomass yield by 3.70 MT/ha.
- Averaged over S rates, combined application of *ammonium sulphate* and *MAP + MST* produced the highest seed (4.51 MT/ha), straw (8.05 MT/ha) and biomass (12.6 MT/ha) yields.
- Averaged over 2023 and 2024, maximum seed (4.71 MT/ha) and biomass (12.8 MT/ha) yields were recorded with 36 kg S/ha; 12 kg S/ha from *ammonium sulphate* + 24 kg S/ha from *MAP + MST*. However, maximum straw yield (8.51 MT/ha) was obtained with the application of 36 kg S/ha; half from *ammonium sulphate* and half from *MAP + MST*.
- *From the two years results, it could be concluded that the S application @ 36 kg Sa/ha significantly improved the seed, straw and biomass yields of canola and the combined application of the two fertilizers proved better than either of the two fertilizers applied alone!*

Residual Effect of SymTRX S10 as a Source of Sulphur on Canola after Canola-Wheat:

- Residual effect of S applied to canola in 2022, as *SymTRX S10* or *ammonium sulphate* or their combinations, on third year canola after canola - wheat was significant i.e., S applied in 2022 improved the third year canola seed yield significantly by 0.65 to 2.56 MT/ha.
- Maximum seed (4.93 MT/ha), straw (8.59 MT/ha) and biomass (13.50 MT/ha) yields were obtained with the application of S @ 36 kg/ha from *ammonium sulphate*. Seed, straw and biomass yields with the application of *SymTRX S10* @ 36 kg S/ha were 3.02, 6.04 and 9.06 MT/ha, respectively.

- Averaged over S sources, application of S @ 36 kg/ha increased the seed yield by 1.25 MT/ha, straw yield by 1.20 MT/ha, and biomass yield by 2.45 MT/ha.
- Averaged over S rates, ammonium sulphate produced the highest seed (4.15 MT/ha), straw (7.42 MT/ha) and biomass (11.56 MT/ha) yields.
- Averaged over 2023 and 2024, results were similar to those in 2023.
- *SymTRX S10, as a source of S, was no better than ammonium sulphate!*

Effect of High Rates of Boron on Canola (seeded late on May 31, 2024):

- *Boron* application @ 0, 1, 2, 3, 4 and 5 kg B/ha was tested in canola.
- Highest seed (3.83 MT/ha), straw (5.98 MT/ha) and biomass (9.8 MT/ha) yields were obtained at 1 kg B/ha.
- Increasing the rate of B application from 1 upwards to 5 kg/ha didn't increase the seed, straw or biomass yield further. Seed, straw and biomass yields at 5 kg B/ha were 3.58, 5.91 and 9.5 MT/ha.
- Boron toxicity is often dreaded! However, it is clear from this experiment that there was no B toxicity in canola even at a high rate (5 kg B/ha) of B application.

2.2.4 Canola and wheat:

Evaluation of TAPP 3 for canola and spring wheat production:

- TAPP 3 that contained 25 % P_2O_5, 8 % K_2O, 7.5 % S, 12.5 % Ca, and 1.6 % Mg was compared as a source of P for canola and wheat production at three rates (100, 150 and 200 kg/ha) of application, with application of P (50 kg P_2O_5/ha) as per soil test from 11-52-0.
- Canola seed yield and wheat grain yield were no better from TAPP 3 than with 11-52-0. However, straw and biomass yield from canola with TAPP 3 @ 100 kg/ha (25 kg P_2O_5/ha) was ~2 MT/ha more than that with 11-52-0 (50 kg P_2O_5/ha). It seems that the vegetative growth in canola was not fully converted into seed yield. The experiment will need to be repeated during the next year(s).

2.3 Bio Products and Other Agronomic Practices:

Effect of Holganix 800$^+$ on Winter Wheat and Winter Rye:

- *Holganix* contains 800$^+$ microorganisms, mainly bacteria and was applied either as soil application at seeding or as foliar application at tillering @ 0.625 l/ha.
- *Holganix 800$^+$* appeared to decrease the winter wheat grain yield from 5.17 MT/ha in check (no *Holganix 800$^+$*) to 4.57 MT/ha with its soil application and to 4.29 MT/ha with its foliar application. However, *Holganix 800$^+$* seemed to increase the winter rye grain yield from 6.89 MT/ha in check (no *Holganix 800$^+$*) to 7.23 MT/ha or 7.22 MT/ha with its soil or foliar application.
- Effect of *Holganix 800$^+$* on plant height was similar to its effect on grain yield of the two crops.

Effect of Holganix 800$^+$ on Spring Crops (Wheat, Barley, Soybean and Canola):

- *Holganix 800$^+$* (soil applied at seeding @ 4.7 l/ha) didn't improve the grain, straw and biomass yields of any of the crops, though there appeared to be some improvement in the straw and biomass yields of soybean and canola.
- Averaged over *Holganix 800$^+$* treatments (no application and application), barley produced the highest grain (3.79 MT/ha) and biomass (8.77 MT/ha) yields and canola the highest straw yield (5.54 MT/ha).

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.
- The fungicides lowered the Septoria rating from 2.0 to 0.5, FHB rating from 1.58 to 0.25 and BYDV rating from 4.4 to 3.8.

- Fungicides didn't improve grain yield of wheat and barley. However, *Stratego* spray increased the grain yield of oats significantly from 5.46 MT/ha to 6.33 MT/ha. Additional sprays of *Prosaro* and *Caramba* didn't increase the oats grain yield further. Averaged over crops, fungicides didn't affect the grain, straw and biomass yields.
- Averaged over fungicides treatments, maximum grain (5.82 MT/ha; 1.36 MT/ha higher than barley and 1.48 MT/ha higher than wheat) and biomass (13.0 MT/ha; 1.10 MT/ha higher than barley and 2.90 MT/ha higher than wheat) yields were obtained with oats. Straw yield was in the order of barley (7.39 MT/ha) ≥ oats (7.23 MT/ha) > wheat (5.78 MT/ha).
- Averaged over 2020-2024, spray of all three fungicides significantly increased the grain (4.79 to 5.88 MT/ha), straw (4.92 to 5.70 MT/ha) and biomass (9.13 to 10.44 MT/ha) yields of only oats.
- Averaged over 2020-2024 and fungicides treatments, grain, yield was in the order of oat (5.29 MT/ha) > barley (4.14 MT/ha) ≥ wheat (4.05 MT/ha).
- Averaged over 2020-2024 and crops, grain, straw and biomass yields were not significantly influenced by the fungicides' sprays.
- *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 and keep spraying fungicides to lower risk of low production.*

Effect of Winter Rye Cover Crop With and Without Fertilizers on the Proceeding Crops (Wheat, Barley, Flax, Canola, Soybean and Lentils):

- Winter rye was seeded in the fall 2023 and killed by Roundup spray in the spring 2024 before seeding the spring crops.
- Dry matter yield of winter rye was recorded in spring before seeding the spring crops. Fertilizers significantly increased the dry matter yield of winter rye by ~40 %.
- Soil tests in spring 2024 indicated that winter rye grown without the fertilizers application lowered the Nitrate N, Mg and Ca in the soil, but not the other nutrients, soil pH, organic matter, CEC and K:Mg ratio.
- Fertilizers application to winter rye didn't improve the tissue contents of P, Ca, Mg, Na and Al.
- Winter rye with or without fertilizers lowered the grain, straw and biomass yields of all crops except the soybean in which it had no effect on the yields.
- Averaged over winter rye treatments, barley recorded the highest grain yield (3.54 MT/ha) followed by wheat (3.01 MT/ha).
- Averaged over crops, fallow plots produced higher grain yield (4.80 MT/ha) than the winter rye with (3.26 MT/ha) or without (3.36 MT/ha) fertilizers.
- *In short, winter rye cover cropping lowered the grain/seed yields of the following spring crops as compared to the fallow plots.*

Effect of Seeding Dates on Winter Wheat Yield:

- Winter wheat (cultivar *AAC Gateway*) was seeded on August 25, September 5, September 15, September 25 and October 5.
- Highest grain (6.64 MT/ha), straw (11.8 MT/ha) and biomass (18.5 MT/ha) yields were obtained with seeding on August 25.
- Grain yields with seedings on September 5, September 15, September 25 and October 5 were 5.04, 4.92, 4.28 and 5.63 MT/ha, respectively.

Effect of Seeding Dates in Winter Camelina:

- Winter Camelina was seeded on August 15, August 25, September 5, September 15, and September 25. The crop seeded on August 15 didn't survive at all.
- Maximum seed (2.11 MT/ha), straw (5.95 MT/ha) and biomass (8.07 MT/ha) yields were obtained with seeding on September 5.

- Seed yields with seedings on August 25, September 15, and September 25 were 1.75, 2.03, and 1.65 MT/ha, respectively.

2.4 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; Synergy barley - 42 MT, 36 bags of L356 canola, 20 bags of L350 canola, 9 bags of L233 canola, 250 bags of Pioneer corn (cultivars P7211, P7574, P7389 and P6910), 190 bags of Pride corn (cultivars A4414RR, A4705HMRR and A4646) and 4 MT of Amirani R2 soybean seeds.
- Area farmers continued to diversify their cropping systems! Lorne Vis seeded soybean for the first time in 80 acres. Gerrit Cramer and Darren are the two other farmers who grew soybean. Ryan and Fritz Jaspers seeded winter rye for grain/and straw production for the second time this year in ~100 acres. Mark Bolt and Gerrit Cramer are at least two other farmers who grew winter rye. Winter rye cultivation acts as a cover crop and produces, forage, grain and straw. Andrew and Gert Brekveld seeded oats + radish cover crop this year. Jason Reid seeded 20 acres under 17 cover crops mixture (forage oats, buckwheat, Italian ryegrass, spring triticale, flax, forage barley, Daikon radish, purple top turnip, hairy vetch, berseem clover, sunflower non GMO forage soybeans, forage peas, sorghum Sudangrass and German millet @ 70 lb seed rate/acre – 48 % of which was comprised by oats and peas) this year. The cover crops were grown without fertilizers; half of the area was chopped and ensiled and half was grazed by the sheep. As per Reid the yield was better than straight barley (grown with fertilizers). Reid also grew oats and sorghum Sudangrass for grazing sheep.
- Ryan and Fritz Jaspers grew Brandon (CWRS) wheat and Synasolis barley each in 250 acres, L356P canola in 230 acres, winter rye in 40 acres, alfalfa in 170 acres, grass hay in 110 acres and corn in 60 acres, half of which was harvested as silage and half will be harvested for grains. Their yields were very good as usual, which they don't wish to reveal to all.
- Aaron and Ed Breukelman had canola in 100 acres (seed yield 1.2 MT/acre), Synasolis barley in 90 acres (grain yield 2.75 MT/acre), Esma barley in 30 acres (grain yield 2.0 MT/acre), silage corn in 125 acres (yield 12 MT/acre; low because of bear damage and 50 acres were not tiled drained) and alfalfa in 100 acres from which he got three cuts.
- Martin Schep had grown 160 acres canola (seed yield 1.2 MT/acre), 50 acres Brandon wheat (grain yield 1.5 MT/acre), 80 acres barley (grain yield up to 2 MT/acre) and 80 acres alfalfa.
- Allan Mol grew 75 acres P505MSL canola (seed yield 1.3 MT/acre), 70 acres AAC Synergy barley (grain yield ~2 MT/acre), 130 acres silage corn, 5 acres of which were damaged by bears (yield 19 MT/acre) and more than 65 acres alfalfa. Mol also seeded AAC Coldfront a new winter wheat variety this fall in 65 acres.
- Ben Breukelman had grown L356P canola in 105 acres and got 1.4 MT seed yield/acre, 55 acres Synasolis barley (grain yield of 2.5 MT/acre), Pride 4646 silage corn in 125 acres with 10 MT/acre yield (at 61 % moisture) which was low because of some plugged tiles (poor drainage) and a serious bear damage. He also grew 240 acres under alfalfa from which he took three cuts.
- Andrew and Gert Brekveld grew 42 acres L233P canola (seed yield 1 MT/acre), 50 acres AAC Starbuck and AAC Wheatland wheat (grain yield 0.9 MT/acre), 58 acres silage corn – Horizon HZ1265 and Maizex 6960 (yield 13 MT/acre). Low yields were due to dry weather in August and September. In addition, he grew alfalfa in 104 acres.
- Evan Grootenboer seeded 90 acres Esma barley with 1.5 MT/acre grain yield, 35 acres silage corn (Pride Seeds varieties – 1017 and 1018); yield was less than that during the last year. He also

experimented with sugar beet in 0.25 acres and got 1,000 lbs of beets. Rest of his acres (125) were under alfalfa/grass from which he took two cuts.

- Henry and Peter Aalbers grew Maizex and Horizon silage corn in 75 acres and got 20 % less yield than last year, 240 acres alfalfa + grass. They had 105 acres under grass hay 60 acres under pasture and oats + peas in 55 acres (yield 5.2 MT/acre). Dennis Ellchook also seeded oats + peas in 16 acres and barley in 85 acres. Growing oats + peas was aimed to lower grain feed for the dairy cows.
- Mark Veurink seeded 125 acres with Starbuck wheat and obtained 1.9 MT/acre grain yield; same as last year. He grew Cattlelac barley in 75 acres with grain yield of 2.4 MT/acre (4.4 % more than last year), canola (Invigor L356PC) in 185 acres, with an average canola seed yield of 1.4 MT/acre (lower than that in the last year). He grew corn in 130 acres for silage production (12 MT/acre forage yield; less than that from the last year partly due to early frost this year and partly due to dry weather in August-September).
- Gerrit Cramer grew Synergy barley in 300 acres, the crop was heavy, there was a lot of straw but the grain yield was low (1.33 MT/acre); obviously due to lodging. Cramer was advised to spray PGR. He would be selling barley grains to Canada Malting Company. He grew Pioneer corn in 190 acres and got 17-18 MT/acre forage yield, which was good; 55 out of 190 acres were combined from which he got 2.5 MT/acre grain yield. He had seeded soybean in 60 acres, but because of late seeding, dry weather in August-September and early frost the grain yield was poor (0.5 MT/acre only). Cramer is planning to put a Soybean Press to get soybean oil and cake from soybeans; that will become operational next year. He is also thinking of buying a drone for fertilizers application and seeding grass as cover crop in standing corn. He had alfalfa in 150 acres, alfalfa + grass mixture in 65-70 acres and grass alone in 50 acres. He got two cuts from grass and three cuts from alfalfa/alfalfa + grass. He obtained 30 % higher yield from alfalfa that was cut only twice last year as compared to the alfalfa that was cut three times during last year.
- Richard Templeman grew Brandon wheat in 80 acres and got 1.5 MT/acre grain yield, Liberty canola in 100 acres (seed yield 1.3 MT/acre), corn 90 acres (yield 27 % less than that during the last year), alfalfa in 150 acres and alfalfa + grass mixture in 50 acres.
- Bernie Kamphof grew 85 acres of fall rye planted early September 2023 – decent crop harvested as forage in the 1st week of June 2024; 36 acres of the rye was planted to 70/30 oats peas mix immediately after harvest and chopped as forage mid August. He seeded 70 acres of Synergy barley for grain (yield 1.8 MT/acre). He had used liquid fertilizer in row and applied wood ash @ 8 MT/acre prior to planting. Synergy barely was also grown for forage on 55 acres under seeded with alfalfa. He also planted 160 acres of corn for silage (cultivars Pickseed 2321, Pioneer 7211, 7389, 7574, and 7844), which had an average yield 12.4 MT/acre. Low yield was partly due to bear damage which was much worse than in 2023.
- Apart from Bernie Kamphof, Dennis Ellchook, Peter Brink, Mike Huber, John Heyes and Lee Swearengen also applied wood ash on their farms.
- Twenty five farmers used land roller for seed bed preparation this year.
- Land clearing to expand farms continued!
- Current acreage under canola is estimated to be more than 1000 acres in a 25 km radius from LUARS.
- Proper crop rotation, high yielding varieties and best nutrient management practices including supply of N from multiple sources (urea, ESN and ammonium sulphate), application of ESN in the seed row, and application of fungicides and plant growth regulators, as recommended by LUARS, were the contributing factors towards reasonably good crop yields. Research at LUARS has proved that use of multiple sources of N instead of its single source was conducive to high 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 9877 MT grains/and seeds (~1500 MT less than the last year) from local producers as at November 26, 2024 at a value of 3.5-4.0 million dollars (~0.4-0.9 million dollar less than the last year) 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, is valued 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.
- *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!*

Dr. Tarlok Singh Sahota CCA **December 3, 2024**
Director LUARS Thunder Bay