

2. Summary of Research Results 2023

Our spring and summer were pretty dry (Rainfall during May, June, July and August was 46.8, 56.4, 71.7 and 41.7 mm, respectively; a total of 216.6 mm rainfall during the four months – the main growing season) – lowest ever! But for that, crop yields could have been better. Spring wheat was much more affected than the other crops and had dismally low grain yields. GDD and CHU during May to September were 2,513 (higher than normal) and 1,511, respectively.

2.1 Screening of crop varieties:

2.1.1 Spring Cereals:

√Barley Varieties:

- Eighteen barley varieties were compared for their production potential.
- *Chambly* (5.70 MT/ha), *AAC Cranbrook* (4.90 MT/ha) and *CDC Bow* (4.67 MT/ha) were the three top grain yielding varieties.
- *CHI209-1* had the highest straw yield (4.74 MT/ha). *AAC Bell* (4.68 MT/ha) and *CDC Bow* (4.31 MT/ha) were the two next best varieties for straw production.
- Biomass yield was highest with *Chambly* (8.92 MT/ha); followed by *AAC Bell* (8.56 MT/ha), and *CDC Bow* (8.46 MT/ha).
- Averaged over 2021-2023, out of 14 common varieties during all these years, *Chambly* (4.97 MT/ha), *Synasolis* (4.89 MT/ha) and *Amberly* (4.84 MT/ha) were the three top grain yielding varieties. *Synasolis* produced the highest straw yield (5.42 MT/ha), followed by *AB Tofield* (5.04 MT/ha) and *AB Advantage* (4.95 MT/ha). Biomass yield was highest with *Synasolis* (10.14 MT/ha).
- Disease rating in 2023 was relatively high; *BYDV* 6.5 in *CDC Bow* to 7.5 in *AAC Cranbrook*, *Esma*, *Synasolis* and *AAC Bell*; *Spot Blotch* 5.75 in *TR1867* to 6.75 in *AAC Ling*, *Chambly* and *Synasolis*.
- Lodging score ranged from 5.25 in *AAC Sorel* to 6.75 in *Synasolis*.
- *Chambly*, *Synasolis* and *Amberly* could be recommended for cultivation on farms. *Synasolis* could be preferred over others because of its highest straw yield (in addition to high grain yield).

√Comparative Performance of PSL Kerns with CDC Bow and Synasolis:

- *PSL Kerns*, a new barley variety, was compared with *CDC Bow* and *Synasolis*.
- *PSL Kerns* resulted in the highest grain (5.35 MT/ha), straw (7.18 MT/ha) and biomass (11.8 MT/ha) yields.
- Grain yield was in the order of *PSL Kerns* (5.35 MT/ha) \geq *CDC Bow* (4.65 MT/ha) \geq *Synasolis* (4.18 MT/ha).
- Straw yields from *CDC Bow* and *Synasolis* were 6.73 MT/ha and 6.41 MT/ha, respectively.
- *PSL Kerns* and *Synasolis* were taller than *CDC Bow* and hence had higher lodging index (8.3/8.5) than *CDC Bow* (6.5).
- *Farmers can start growing PSL Kerns on their farms!*

√Malting Barley Varieties:

- Fifteen varieties were evaluated for grain and straw production. *AAC Prairie* was the new variety.
- Three top grain yielding varieties were *Torbellino* (4.78 MT/ha), *CDC Bow* (4.75 MT/ha) and *CDC Copper* (4.74 MT/ha). *UC Capay* recorded the highest 1000 kernel weight (60), followed by *CDC Bow* (52).
- *UC Capay* recorded the highest straw yield (5.71 MT/ha), followed closely by *CDC Bow* (5.58 MT/ha).
- Averaged over 2021-2023, *CDC Bow* produced the highest grain yield (5.10 MT/ha). The next two best varieties for grain production, over three years, were *AAC Synergy* (4.90 MT/ha) and *CDC Copeland* (4.84 MT/ha).

- Averaged over 2021-2023, *CDC Copeland* registered the highest straw yield (7.32 MT/ha). The next two varieties for high straw yield were *CDC Copper* (6.23 MT/ha) and *AAC Connect* (6.17 MT/ha).
- *UC Capay* and *CDC Bow* produced the highest biomass (both 9.8 MT/ha) in 2023. Averaged over 2021-2023, *CDC Copeland* produced the highest biomass yield (12.3 MT/ha). Biomass yield from *CDC Copper*, *AAC Synergy* and *CDC Bow* was 11.1-11.2 MT/ha.
- While there was no serious lodging in any of the varieties, disease(s) ratings seemed to be high; *BYDV* 6.3 – 7.0 and *Spot Blotch* 5.8 – 6.3. May be because of this reason, grain yield was relatively low (Trial mean 3.79 MT/ha).
- Considering the grain yield, from the past three years, *CDC Bow*, *AAC Synergy* and *CDC Copeland* are recommended for cultivation on farms.
- Only three varieties (*Butta12* - 14.49 % grain protein, *CDC Kindersley* – 13.3 % grain protein and *TR14617* – 13.2 % grain protein) exceeded the grain protein content limit of 13.0 %. In all other varieties, grain protein content ranged from 10.5 % in *CDC Copper* to 12.9 % in *KWS Kellie*. For other malt quality parameters please refer to the main report.

√*Canadian Western Red Spring (CWRS) Wheat Varieties:*

- Fifteen CWRS wheat varieties were evaluated for their production potential.
- Wheat was most affected by the drought during spring and summer. Hence wheat grain and straw yields were very poor.
- Grain yields in the highest yielding varieties were in the order of *AAC Wheatland VB* (2.77 MT/ha) \geq *SY Gabbro* (2.59 MT/ha) = *AAC Starbuck* (2.58 MT/ha). Grain yield in other varieties ranged from 1.63 MT/ha in *CS Daybreak* to 2.39 MT/ha in *Rednet*.
- *AAC Wheatland VB* produced the highest straw yield (4.43 MT/ha) - up to 1 MT/ha higher than the three next best varieties for straw production (*Rednet* 3.54 MT/ha, *AAC Starbuck* 3.44 MT/ha and *SY Gabbro* 3.43 MT/ha). Straw yield in all other varieties varied from 1.83 MT/ha in *AAC Leroy* to 3.23 MT/ha in *PT786*. *AAC Wheatland VB* had the highest biomass yield (6.75 MT/ha).
- Disease ratings were relatively high; *Septoria* 6.5-7.5 and *Spot Blotch* 5.3-5.8.
- Averaged over 2021-2023, three top grain yielding varieties were *AAC Starbuck* (3.99 MT/ha), *Brandon* (3.86 MT/ha) and *Rednet* (3.76 MT/ha). Only *AAC Starbuck* (5.60 MT/ha), *AAC Wheatland VB* (5.08 MT/ha) and *AAC Leroy* (5.00 MT/ha) gave 5 MT/ha or more than 5 MT/ha straw yield.
- Three varieties that were common during 2019-2023, had similar average grain yields over these years; *Brandon* 4.28 MT/ha, *AAC Wheatland* 4.24 MT/ha and *AAC Starbuck* 3.94 MT/ha.
- Area producers could grow *AAC Starbuck*, *Brandon*, *Rednet* and *AAC Wheatland VB*. *AAC Starbuck* and *AAC Wheatland* could be preferred if high straw production is a consideration.

√*New Canadian Western Red Spring (CWRS) Wheat Varieties:*

- Six CWRS wheat varieties (*AAC Wheatland*, *Brandon*, *Rednet*, *AAC Redberry*, *AAC Leroy* and *Redcliff*) were compared for their production potential.
- Highest grain yield (3.55 MT/ha) was obtained with *AAC Wheatland* followed by *Brandon* (3.08 MT/ha) and *Rednet* (3.01). *AAC Leroy* gave the highest straw (4.64 MT/ha) and *AAC Wheatland* the highest biomass yield (7.42 MT/ha).
- Averaged over 2022 and 2023, there was no significant difference between the grain (3.34-3.73 MT/ha), straw (4.62-5.18 MT/ha) and biomass (7.96-8.68 MT/ha) yields of different varieties. Though in numerical terms, *AAC Wheatland* recorded the highest grain, straw and biomass yields.
- *Farmers could grow any of the six wheat varieties though they could prefer AAC Wheatland.*

√*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.

- Grain yields were dismally low due to very dry spring and summer. Last year, *Rednet* recorded the highest grain (5.36 MT/ha) yield in this experiment and this year *Brandon* (2.56 MT/ha) gave the highest grain yield. Other varieties or blends of the varieties didn't yield as much as *Brandon*.
- Straw (6.50 MT/ha) and biomass yields (7.89 MT/ha) were the highest with *AAC Wheatland*.
- Averaged over 2022 and 2023, *Rednet* produced the highest grain (3.63 MT/ha) and Biomass (9.49 MT/ha) yields. *Rednet* and *AAC Wheatland* equaled in the straw yield (6.76 MT/ha).

√Oat Varieties:

- Nine 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. *Kalio*, a new variety this year, is also a milling variety.
- Three varieties that gave more than 5 MT/ha grain yield were *AAC Kongsore* (5.27 MT/ha), *Kalio* (5.14 MT/ha) and *AAC Excellence* (5.04 MT/ha). Grain yield from *AC Rigodon*, an old timer good performer, was 4.45 MT/ha.
- *AAC Reid* recorded the highest straw (5.29 MT/ha) and the biomass (8.47 MT/ha) yields.
- Disease rating for *BYDV* was relatively high (6.0-7.3) and that for *Spot Blotch* was medium (4.3-4.8) for all varieties.
- Averaged over 2020 to 2023, there was no significant difference in the grain, straw and biomass yields of the four varieties (*AAC Douglas*, *AC Rigodon*, *Akina*, and *CDC Endure*) common during these years.
- Oat growers could try growing *AAC Kongsore*, *Kalio*, and *AAC Excellence* in 2024.

2.1.2 Winter Cereals:

√Winter Wheat Varieties:

- Seven winter wheat varieties were compared for their production potential including two new varieties *AAC Vortex* and *Coldfront*.
- Grain yield ranged from 4.23 MT/ha (*PRO 81*) to 5.17 MT/ha (*AAC Vortex*). However, the grain yield differences between the varieties were not significant.
- Straw yield was highest (10.4 MT/ha) with *Coldfront* followed closely by *AAC Vortex* (9.6 MT/ha).
- Plant height ranged from 86 cm in *AAC Gateway* to 88 cm in *AAC Vortex* and *Coldfront*.
- Averaged over 2019-2021 and 2023, *AAC Gateway* gave 1.30 MT/ha higher grain yield than the old variety *CDC Falcon*.

√Winter Barley Varieties:

- Three winter barley varieties (*McGregor*, *McKeller* and *Scala*) were tested for their winter survival and yield.
- *Scala* didn't survive the winter this time and *McGregor* and *McKeller* had very poor winter survival (18 % and 28 %, respectively).
- Despite poor survival, *McKeller* gave good grain yield (5.33 MT/ha). Grain yield of *McGregor* was 3.81 MT/ha.
- Surprisingly, *McGregor* recorded higher straw yield (4.38 MT/ha) than *McKeller* (3.36 MT/ha).

√Winter Rye Varieties:

- Five winter rye varieties were compared for their production potential including a new variety *KWS Serafino*.
- *Bono* recorded the lowest (6.98 MT/ha) and *Hazlet* the highest (7.83 MT/ha) grain yield. Grain yield of *Serafino* was (7.71 MT/ha). However, the grain yield differences between the varieties were not significant.
- Straw yield was highest (~12 MT/ha) with *Hazlet*, followed closely by *Brasetto* (11.1 MT/ha).
- *Hazlet* produced the tallest (130 cm) and *Bono* the shortest plants (110 cm).

- Averaged over 2019-2021 and 2023, grain yield ranged from 4.85 MT/ha in *Bono* to 5.12 MT/ha in *Guttino*. *Hazlet* (7.79 MT/ha) and *Brasetto* (7.76 MT/ha) recorded higher straw yield than *Bono* (6.62 MT/ha) and *Guttino* (6.36 MT/ha). *Serafino* was not in the picture then.

2.1.3 Grain Legumes and Oil Seeds Varieties:

√Soybean Varieties (Seeded on May 18, 2023):

- Eighteen varieties were compared for their grain production potential.
- Deer damaged the soybeans varieties trial completely and we couldn't record the yield data. Our efforts to dispel deer with Irish soap (that worked during the previous years) and deer repellent (a liquid spray) didn't bear fruits.
- *From the last years results, we can say that the area producers could grow Bourke R2X and Lono R2 on their farms!*

√Linseed Flax Varieties (Seeded on May 22, 2023):

- Twelve varieties of linseed flax were compared.
- Flax seed yield was dismally low this year, due to hot and dry weather, and ranged from 0.59 MT/ha in *AAC Bright* and *CDC Melyn* to 1.59 MT/ha in *CDC Plava*.
- Straw (5.03 MT/ha) and biomass (6.06 MT/ha) yields were the highest with *CDC Sorrel*.
- Averaged over 2021 to 2023, *CDC Plava* gave the highest seed yield (1.27 MT/ha) and *AAC Prairie Sunshine* produced the highest straw (5.65 MT/ha) and biomass (6.49 MT/ha) yields.
- Good crop growth as indicated by the high straw yield couldn't be converted into good seed yield due to hot and dry weather and short growing season.

√Liberty Canola Varieties (Seeded on May 16, 2023):

- Twelve varieties were evaluated; some of them new and more than half of which had Clubroot resistance/or shatter reduction trait.
- Three top seed yielding varieties were *P501L* (5.90 MT/ha), *P506ML* (5.27 MT/ha) and *InVigor® L350PC* (5.16 MT/ha). Straw yield (*P501L*: 13.60 MT/ha, *P506ML*: 12.7 MT/ha and *InVigor® L350PC* 10.4 MT/ha) followed the same trend as the seed yield. *P* stands for 'Shatter Reduction' and *C* for 'Clubroot Resistance'.
- Averaged over 2022 and 2023, seed yields were in the order of *P501L* (4.49 MT/ha) ≥ *P506ML* (3.81 MT/ha). *P501L* (10.3 MT/ha) and *P506ML* (9.6 MT/ha) registered the highest straw yield.
- *Area growers could try cultivating P501L, P506ML and InVigor® L350PC on their farms in 2024!*

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

- Twelve varieties were compared for their production potential.
- *DK901TF* gave the highest seed yield (5.57 MT/ha). The next three best varieties in seed yield were *DKTFLL22CRSC* (4.94 MT/ha), *BY6204TF* (4.92 MT/ha) and *DK902TF* (4.88 MT/ha). *CR* stands for Clubroot resistance, *TF* for Truflex and *SC* stands for straight cut.
- *CS3100 TF* produced the highest straw yield (15.9 MT/ha); 4.8 MT/ha higher than the next best variety *BY6204TF* (11.1 MT/ha) for straw production.
- Averaged over the years, *BY6204TF* gave the highest seed yield, 3.98 MT/ha averaged over 2021 to 2023 and 4.27 MT/ha averaged over 2022 to 2023.
- *Farmers, if they decide to grow RR canola, could prefer the new variety DK901TF for cultivation on their farms.*

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

- Six varieties were compared for their production potential.
- Highest seed yield (4.88 MT/ha) was obtained with *5545CL*.
- Straw (9.14 MT/ha) and biomass (12.52 MT/ha) yields were highest with *CS2700CL*.
- Averaged over 2021-2023, *5545CL* produced the highest seed (3.53 MT/ha) and biomass (10.0 MT/ha) yields, and *CS2700CL* the highest straw yield (7.21 MT/ha).

2.1.4 Forage Crops/Varieties:

√Spring Barley Varieties for Forage Production:

- Eighteen varieties were evaluated for forage production.
- Highest forage dry matter yield was registered by *CHI209-1* (15.4 MT/ha; 8.8 % protein). Next two best yielding varieties were *Boroe* (13.0 MT/ha; 8.5 % protein) and *AB Cattelac* (12.5 MT/ha; 12.5 % protein). *Amberly*, last year's top yielding variety, yielded 11.5 MT/ha (with highest protein content - 13.8 %) this year.
- *AB Hague* (12.9 % protein) and *AB Wrangler* (12.4 % protein) were the next best varieties to *Amberly* in the protein content (13.8 %).
- Averaged over 2021-2023, *Amberly/Oceanik* (10.16 MT/ha), *Boroe* (9.87 MT/ha) and *AB Tofield* (9.81 MT/ha) were the four top forage producing varieties. And, *AB Hague* (12.5 %), *AB Tofield* (11.5 %) and *AB Advantage* (11.4 %) were top ranking varieties for protein content.
- RFV was highest in *Esma* (151) followed closely by *Oceanik* (147) and *Amberly* (146).
- Averaged over 2021-2023, *Oceanik* had the highest RFV (155). Two next best varieties in RFV were *Chambly* (134) and *AB Wrangler* (133).
- Considering the dry matter yield, *Amberly*, *Oceanik*, *Boroe* and *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:

- Fifteen varieties were evaluated for forage production.
- Highest forage dry matter yield (12.6 MT/ha) was obtained with *CDC Fraser* and *CDC Copper* followed closely by *CDC Kindersley* (12.0 MT/ha) and *CDC Copeland* (11.94 MT/ha).
- Averaged over 2021-2023, *CDC Copper* (11.45 MT/ha) and *Torbellino* (10.41 MT/ha) produced the highest forage dry matter yields. Dry matter yield from *CDC Fraser* yield (10.18 MT/ha) was more or less the same as that from *Torbellino*.
- *Butta 12* (13.4 %), *AAC Goldman* (12.6 %) and *CDC Kindersley/KWS Kellie* (11.8/11.7 %) had higher protein content than the other varieties (8.3 % to 10.9 %).
- Averaged over 2021-2023, *AAC Goldman* (11.3 %), *CDC Fraser* (10.8 %) and *CDC Bow* (10.4 %) had higher protein content than the other varieties (9.2 % in *AAC Synergy* to 10.3 % in *TR14617* and *CDC Copper*).
- *UC Capay* had the highest RFV (171) followed by *UC Tahoe* (147).
- Averaged over 2021-2023, *Torbellino* had the highest RFV (149) followed by *CDC Copper* (133)
- Considering the dry matter yield and RFV 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 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.
- *Response WT* (8,508 kg/ha), *Elite* (8,406 kg/ha) and *Revolution MD* (8,319 kg/ha) gave around 1 MT/ha higher dry matter yield than *AAC Trueman* (7,367 kg/ha) and Roundup Ready *WL319HQ* (7,337 kg/ha). However, the yield differences between the varieties were non significant.
- Averaged over three years (2021-2023), *Response WT* produced the highest (7,632 kg/ha) and *AAC Trueman* the lowest (6,789 kg/ha) dry matter yield. Plant/stem count over the years in *AAC Trueman* had come down, which probably resulted in its lower yield.
- In the first cut, *Elite* recorded the highest (21.4 %) and *AAC Trueman* (18.0 %) the lowest protein content. Protein content in *Response WT*, the highest yielding variety, was 18.3 %.
- In the second cut, *Response WT* (22.5 %)/and *AAC Trueman* (22.4 %) had the highest and *Revolution MD* had the lowest (20.9 %) protein content.

- RFV was highest in *Elite* (128) in the first cut and highest in *AAC Trueman* (140) in the second cut, followed closely by *Response WT* (137). Higher RFV could mean higher milk yield.
- Third cut was also taken this year. Yield trend with the three cuts was the same as that with the two cuts.
- *Considering the dry matter yield, protein content and RFV, Response WT, Elite and 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.
- *Revolution MD* gave the highest (6,867 kg/ha) and *Evermost* (5,615 kg/ha) the lowest dry matter yield.
- Protein content in the first cut ranged from 16.9 % in *Dynasty* to 21.3 % in *SW 4107*.
- Second cut protein content didn't vary much with the varieties (22.2 % in *SW 4107* to 23.3 % in *Shockwave BR*).
- *Evermost* had the highest RFV (122) in the first cut and *Revolution MD* and *SW 4107* had the highest RFV (134) in the second cut.
- Averaged over 2022 and 2023, *Revolution MD* gave the highest dry matter yield (5,421 kg/ha), followed by *SW 4107* (5,199 kg/ha) and *Shockwave BR* (5,028 kg/ha).

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

- *Galega* gave 670 – 1,240 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 2023, *Galega* (6,690 kg/ha/year) produced higher dry matter yield than *alfalfa* (6,135 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 a bit higher in *alfalfa* (132) than in *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 choice 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 after 2021.
- Dry matter yields from *Galega, alfalfa* and *Trefoil* were 5,946, 9,025 and 6,997 kg/ha.
- In the first cut, *Galega* had 3.8 % point higher protein content than *alfalfa* and *Trefoil* had 2.5 % point higher protein content than *alfalfa*.
- Second cut protein content was in the order of *Trefoil* (22.6 %) > *Galega* (22.0 %) > *alfalfa* (19.9 %).
- *Trefoil* had the highest RFV in the first (162) as well as in the 2nd cut (148).

√*Corn Silage Varieties:*

- Thirteen silage corn varieties were evaluated for their forage production potential.
- *DKC30-07RIB* (14.6 MT/ha), *MS 6902 R* (14.3 MT/ha) and *DKC29-89RIB* (13.7 MT/ha) recorded higher dry matter yield than the other varieties (10.5 – 13.1 MT/ha).
- Protein content was relatively low and ranged from 6.5 % in *MS 7420R* to 7.8 % in *P7417AM*. *MS 6902 R* which gave high yield had 7.7 % protein content. Protein content in *DKC30-07RIB* was 7.0 %.
- *DKC29-89RIB* (212) and *P7211AM* (208) had considerably higher RFV than the other varieties (112 - 178).
- Based on two years (2021 and 2023) averages, *DKC26-40RIB* (18.5 MT/ha), *DKC29-89RIB* (18.4 MT/ha) and *DKC30-07RIB* (18.0 MT/ha) gave significantly higher dry matter yield than the other varieties.

- Considering the yield from the two years, DKC26-40RIB, 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 (10.8 MT/ha) followed by 9.4 MT/ha by *Pacific Grage Brand Hybrid*. Dry matter yield in the two other varieties were 8.8 MT/ha in BMR and 8.7 MT/ha in *Summer Select*. However, the yield differences between the four varieties were not significant.
- In the first cut, BMR recorded the highest (19.2 %) and *Pacific Grage Brand Hybrid* the lowest (14.8 %) protein content.
- In the second cut, SS2 BMR had the highest (20.9 %) and BMR had the lowest (16.5 %) protein content.
- In the first cut, RFV was the highest (147) in BMR, whereas SS2 BMR had the highest (123) RFV in the second cut.

√*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 3,583 kg/ha with grasses blend (50% *Timothy*, 42.5% *Brome Grass*, 7.5% *Orchard Grass*) to 6,394 kg/ha with legumes blend (75% *Grazing Alfalfa*, 25% *AAC Sainfoin*) – same trend as last year. Two next best treatments, with legumes blends, were *Grazing Alfalfa* alone (5,612 kg/ha) and *NirtoMaster – SA + Barricade* (5,354 kg/ha).
- *AC Langille Trefoil* had the highest protein content in the first (22.8 %) as well as in the second cut (23.8 %). Two other treatments that had reasonably good protein content in the first cut were *Grazing Alfalfa* alone (19.4 %) and 75% *Grazing Alfalfa* + 25% *AAC Sainfoin* (19.2 %). In the second cut, 75% *Grazing Alfalfa* + 25% *AAC Sainfoin* (22.3 %) and *NitroMaster – V + Barricade* (22.2 %) were the next best in the protein content.
- RFV was the highest (137) in *AC Langille Trefoil* in the first cut, whereas in the second cut RFV was 1 point higher in *AC Bruce Trefoil* (166) than in *AC Langille Trefoil* (165).
- Averaged over 2022 and 2023, 75% *Grazing Alfalfa* + 25% *AAC Sainfoin* produced the highest dry matter yield (5,106 kg/ha).
- Combined cultivation of alfalfa and sainfoin could therefore be recommended!

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:11 ppm, and Ammoniacal N:14 ppm.
- Treatments included all combinations of four seeding dates (May 12 to June 2 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 (3.52 MT/ha) yield was obtained with seeding on May 12, application of N @ 160 kg/ha and no Manipulator spray. While maximum straw (6.04 MT/ha) and biomass (7.34 MT/ha) yields were recorded with June 2 seeding supplied with 160 kg N/ha and sprayed with Manipulator.
- Averaged over N rates and Manipulator treatments, May 12 seeding produced the highest grain (3.09 MT/ha) and straw (3.99 MT/ha) yields. Biomass yield was highest with May 12 (6.40 MT/ha) and May 27 (6.45 MT/ha) seedings.
- Averaged over seeding dates and Manipulator treatments, increasing N rate from 80 to 160 kg/ha didn't significantly improve the grain or the straw yield, though it increased the biomass yield from 5.25 MT/ha to 6.07 MT/ha.

- Averaged over seeding dates and N rates, Manipulator spray didn't increase the grain, straw or biomass yields. It reduced the plant height only by 2 cm.
- Averaged over 2021 and 2023, maximum grain (4.18 MT/ha), straw (5.05 MT/ha) and biomass (8.9 MT/ha) yields were recorded with seeding on May 12, application of N @ 80 kg/ha and no Manipulator spray.
- *The results over two years indicated that wheat should be seeded as soon as possible in the spring, 80 kg N/ha was sufficient for wheat 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:11 ppm, and Ammoniacal N:14 ppm.
- Treatments included all combinations of four seeding dates (May 12 to June 2 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 yield (5.86 MT/ha) was recorded with seeding on May 12, application of N @ 160 kg/ha and no Manipulator spray.
- Straw (5.35 MT/ha) and biomass (9.30 MT/ha) yields were highest with seeding on May 27, sprayed with Manipulator and supplied with N @ 160 kg/ha.
- *Manipulator spray improved the grain yield only in May 27 seeding supplied with N @ 160 kg/ha.*
- Averaged over N rates and Manipulator treatments, May 12 seeding recorded the highest grain (5.14 MT/ha) and biomass (7.56 MT/ha) yields. Whereas, straw yield was the highest (4.56 MT/ha) with June 2 seeding.
- Averaged over seeding dates and Manipulator treatments, there was no significant difference in grain yield with 80 and 160 kg N/ha. However, increasing the rate of N application from 80 to 160 kg N/ha improved the straw and biomass yields significantly (straw by 0.64 Mt/ha and biomass by 0.88 MT/ha).
- Averaged over seeding dates and N rates, Manipulator spray didn't increase the grain, straw or biomass yields. It didn't shorten the plants either.
- Disease ratings were relatively high for BYDV (6.5-7.3) and Spot Blotch (6.5-7.5), but low for FHB (up to 3 in all treatments).
- Averaged over 2021 and 2023, maximum grain yield (5.73 MT/ha) was recorded with seeding on May 12, application of N @ 160 kg/ha and no Manipulator spray. Straw was highest with seeding on June 2, sprayed with Manipulator and supplied with N @ 160 kg/ha. highest biomass yield was obtained with May 27 seeding, supplied with N @ 160 kg/ha and sprayed with Manipulator.
- *Farmers should apply 160 kg N/ha to early seeded barley and 80 kg N/ha to late seeded barley. Manipulator spray should be done only if there is a risk of lodging.*

√*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):*

- Neither Manipulator nor Moddus significantly increased the grain yield of wheat or barley.
- Maximum grain (6.11 MT/ha) and biomass (10.36 MT/ha) yields were obtained with barley supplied with 160 kg N/ha without spraying Manipulator or Moddus.
- Barley supplied with 80 kg N/ha and not sprayed with Moddus or Manipulator and barley supplied with 160 kg N/ha and sprayed with Moddus recorded the highest straw yield (5.13/5.12 MT/ha).
- Averaged over N rates and Manipulator/Modus treatments, barley (5.78 MT/ha) grain yield was double than that from wheat (2.76 MT/ha). While the straw yield from barley was only marginally higher (by 0.60 MT/ha) than that from wheat, the biomass yield from barley was 3.24 MT/ha higher than that from wheat.
- Averaged over crops and Manipulator/Modus treatments, grain, straw or biomass yield didn't increase significantly with the application of N/and increasing rates of N application.

- Averaged over crops and N rates, *Moddus* or *Manipulator* spray didn't significantly increase the grain, straw or biomass yield. Plant height too remained unaffected by the *Moddus* or *Manipulator* spray.
- Averaged over 2021-2023, barley produced 2.17 MT/ha higher grain yield, 0.82 MT/ha higher straw yield and 2.8 MT/ha higher biomass yield than wheat. N and *Moddus/Manipulator* had no significant effect on grain, straw and biomass yields.
- *Because of the exceptionally dry weather in spring and early summer this year, there was no significant response to application of N and Moddus/Manipulator. 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 UtrishaTM N For Spring Wheat Production:*

- *UtrishaTM 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.
- Neither *UtrishaTM N* nor N had any significant effect on grain, straw or biomass yield.
- This was the first year for this experiment and we will repeat it next year(s).

√*Residual Effect of MAP + MST Applied to Canola (2022) on Spring Wheat (2023):*

- None of the treatments (S applied to canola last year through *MAP + MST* or *ammonium sulphate* or from blends of the two fertilizers.) increased the grain yield over the check (*No S* treatment). Straw and biomass yields were also not affected by the S treatments.
- Neither S nor sources of S had any effect on wheat grain, straw or biomass yield.

√*Residual Effect of SymTrex Applied to Canola (2022) on Spring Wheat (2023):*

- Grain, straw and biomass yields were not affected by the treatments - S applied to canola last year through *SymTrex* or *ammonium sulphate* or from blends of the two fertilizers.

2.2.2 Winter Cereals:

√*Evaluation of Urea, ESN, Urea SuperU, Their Blends, and Urea Treated with Anvol for production of Winter Wheat:*

- Urea, ESN and Urea SuperU, 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 SuperU @ 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: 14 ppm, Ammoniacal N: 5 ppm.
- Split application of urea (30 kg N/ha at seeding and 90 kg N/ha in spring) gave the highest grain yield (7.00 MT/ha). Grain yield in the no N check treatment was 5.69 MT/ha. This is the first year when split application of urea gave the highest grain yield.
- No other treatment produced higher grain yield than the no N check. Grain yields in the treatments other than no N check and split application of urea (30 kg N/ha at seeding and 90 kg N/ha in spring) ranged from 5.02 MT/ha with urea @ 90 kg N/ha + ESN @ 30 kg N/ha to 6.36 MT/ha with urea @ 160 kg N/ha.
- Straw yield in all treatments except the two treatments (urea @ 90 kg N/ha + ESN @ 30 kg N/ha and urea superU @ 100 kg N/ha) were above 11 MT/ha.
- Highest straw yield (12.5 MT/ha) was obtained with urea @ 120 kg N/ha treated with Anvol, followed by 12.3 MT/ha with urea @ 90 kg N/ha + urea superU @ 30 kg N/ha and 12.0 MT/ha with urea @ 30 kg N/ha + ESN @ 90 kg N/ha. Straw yield in no N check was 11.1 MT/ha.

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 superU, urea + urea superU (2:1 ratio on N basis) and urea + ESN + urea superU each @ 60 kg N/ha (total 180 kg N/ha) significantly improved the canola seed yield as compared to the check.

- Seed yield was highest (4.44 MT/ha) with urea @ 240 kg N/ha + urea superU @ 120 kg N/ha, closely followed by urea @ 180 kg N/ha + ESN @ 90 kg N/ha (4.04 MT/ha) and urea superU @ 180 kg N/ha (3.97 kg N/ha).
- Straw yield was highest (6.58 MT/ha) with urea @ 180 kg N/ha + ESN @ 90 kg N/ha.
- Averaged over N sources, seed yield increase above 90 kg N/ha wasn't significant (drought effect!). Straw yield levelled off after 180 kg N/ha.
- Averaged over N rates, seed yield differences (up to 0.40 MT/ha) between the sources of N were not significant.
- Averaged over N sources and years (2020, 2021 and 2023), highest seed yield (3.66 MT/ha) was obtained with N @ 270 kg N/ha and N @ 360 kg N/ha. In other words, seed yield at these two rates was the same. Straw (7.05 MT/ha) and biomass (10.71 MT/ha) yields were the highest with 270 kg N/ha.
- Averaged over N rates and years (2020, 2021 and 2023), seed (3.42-3.47 MT/ha), straw (6.48-6.76 MT/ha) and biomass (9.94-10.22 MT/ha) yields didn't depict any significant differences between the sources of N.
- But for the moisture stress in the spring and summer, seed yields and response to N could be better!
- *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 1.79 MT/ha, straw yield by 2.05 MT/ha and biomass yield by 3.68 MT/ha as compared to the check (No N).
- Highest seed yields were recorded with urea @ 120 kg N/ha + PurYield @ 60 kg N/ha (4.09 MT/ha), urea @ 180 kg N/ha (3.87 MT/ha) and urea @ 90 + ESN @ 90 (3.86 MT/ha). However, seed yield differences between different fertilizers or their blends were not significant.
- Highest straw yield was produced with urea @ 180 kg N/ha, followed by urea @ 120 kg N/ha + PurYield @ 60 kg N/ha (6.55 MT/ha) and urea @ 90 + ESN @ 90 (6.43 MT/ha).
- Yield potential wasn't fully realized because of dry spring and summer. We will repeat the experiment in the coming years. *However, PurYield showed promise and has the potential to replace ESN. 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:

- Three top seed yielding treatments were 36 kg S/ha applied in two equal amounts from *ammonium sulphate* and MAP + MST (5.32 MT/ha), 24 kg S/ha from *ammonium sulphate* and 12 kg S/ha from MAP + MST (5.21 MT/ha) and 36 kg S/ha from *ammonium sulphate* (5.14 MT/ha) with P applied as per soil test. Same three treatments recorded higher straw yields (7.57-7.78 MT/ha) than the other treatments (6.79-7.33 MT/ha).
- Averaged over S rates, *ammonium sulphate* alone (5.10 MT/ha) was as good as *ammonium sulphate* + MAP + MST (5.16 MT/ha) in seed yield.
- Averaged over years (2021-2023), 36 kg S/ha from *ammonium sulphate* (3.82 MT/ha), 36 kg S/ha in two equal amounts of S from *ammonium sulphate* and MAP + MST (3.82 MT/ha), and 24 kg S/ha from MAP + MST and 12 kg S from MAP + MST (3.78 MT/ha) produced the equal seed yield. Straw yield was the highest (7.81 MT/ha) with 36 kg S/ha from MAP + MST, followed closely by 36 kg S/ha in two equal amounts of S from *ammonium sulphate* and MAP + MST (7.71 MT/ha).
- *S to canola could be applied @ 36 kg S/ha either through ammonium sulphate alone or 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 2021, as *MAP + MST* or *ammonium sulphate* or their combinations, on third year canola after wheat – canola was significant i.e., S applied in 2021 improved the third year canola seed yield significantly by 0.79 to 1.95 MT/ha.
- Maximum seed yield (4.52 MT/ha) was recorded with 36 kg S/ha either as 12 kg S/ha from *ammonium sulphate* + 24 kg S/ha from *MAP + MST* or the entire amount of S @ 36 kg/ha from *MAP + MST*.
- Maximum straw yield was obtained with application of S @ 36 kg S/ha applied in tow equal halves from *ammonium sulphate* and *MAP + MST*.
- Averaged over S sources, S @ 36 kg/ha significantly improved the seed yield by 1.54 MT/ha. However, straw and biomass yields weren't improved.
- Averaged over S rates, *MAP + MST* produced the highest seed (4.52 MT/ha) and biomass (12.7 MT/ha) yields. Straw yield was maximum (8.56 MT/ha) in the check treatment (No S application).

√*Evaluation of SymTRX10 ((10 % S and 16 % organic matter)) as a Source of S for Canola Production:*

- Maximum seed yield (5.62 MT/ha) was obtained with application of 24 kg S/ha from *ammonium sulphate* and 12 kg S/ha from *SymTRX* followed closely by application of 36 g S/ha from *SymTRX* (5.44 MT/ha). Seed yield with the application of 36 kg S/ha from *ammonium sulphate* was 4.92 MT/ha.
- Straw yield was highest (6.70 MT/ha) with the application of 24 kg S/ha from *ammonium sulphate* and 12 kg S/ha from *SymTRX* and with the application of 36 kg S/ha from *ammonium sulphate* (with P applied as per soil test).
- Averaged over S rates, *SymTRX* (5.44 MT/ha) produced higher seed yield than *ammonium sulphate* (4.59 MT/ha) and the blends of the two fertilizers (4.61 MT/ha). However, the yield differences were non-significant.
- Averaged over 2021-2023, Maximum seed (4.85 MT/ha) and straw yields (8.55 MT/ha) were obtained with application of 24 kg S/ha from *ammonium sulphate* and 12 kg S/ha from *SymTRX* followed closely by application of 36 g S/ha from *ammonium sulphate* (seed: 4.54 MT/ha and straw: 8.42 MT/ha).
- Farmers may try applying 1/3rd of S through *SymTRX* and 2/3rd S from *ammonium sulphate*.

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

- Residual effect of S applied to canola in 2021, as *SymTRX S10* or *ammonium sulphate* or their combinations, on third year canola after wheat – canola was significant i.e., S applied in 2021 improved the third year canola seed yield significantly by 0.44 to 1.40 MT/ha.
- Maximum seed (3.17 MT/ha), straw (8.52 MT/ha) and biomass (11.69 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 3.09, 7.21 and 10.30 MT/ha, respectively.
- Averaged over S sources, application of S @ 36 kg/ha increased the seed yield by 1.01 MT/ha, straw yield by 0.55 MT/ha, and biomass yield by 1.56 MT/ha.
- *SymTRX S10, as a source of S, was no better than ammonium sulphate!*

2.2.4 Forages:

√*Evaluation of Urea, ESN, Urea SuperU, Their Blends, and Urea Treated with Anvol for forage production of winter wheat:*

- Forage dry matter yield of winter wheat without N application was 16.7 MT/ha.
- ESN @ 120 kg N/ha produced the highest forage dry matter yield of winter wheat (22.2 MT/ha; 5.5 MT/ha higher than in No N check), followed by urea @ 90 kg N/ha + urea superU @ 30 kg N/ha (21.4 MT/ha). Dry matter yield with urea @ 120 kg N/ha was 19.8 MT/ha.
- The treatments that gave higher protein content than all other treatments were urea superU @ 120 kg N/ha (8.9 %), urea treated with Anvol @ 120 kg N/ha (8.8 %), urea @ 120 kg N/ha (8.3 %), and urea @ 60 kg N/ha + ESN 60 kg N/ha (8.2 %).

- RFV was highest with urea @ 60 kg N/ha + ESN 60 kg N/ha (128), and urea treated with Anvol @ 120 kg N/ha (127). Next best treatment for high RFV was urea @ 160 kg N/ha (121).

√*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. In the previous years, 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. This year, regular seeding at 15 cm spacing (8,877 kg/ha) or missing alternate rows (8,710 kg/ha) with S @ 36 kg/ha gave the highest dry matter yield.
- Averaged over rates of S application, dry matter yield didn't vary significantly (7,756 to 8,241 kg/ha) with the row spacing/geometry, though missing alternate rows numerically produced the highest dry matter yield (8,241 kg/ha).
- Averaged over rates of S application and years, dry matter yields from regular seedings at 15 cm, missing alternate rows and missing one row after every two rows were similar; 6,291, 6,053 and 6,284 kg/ha, respectively.
- Averaged over row spacings/geometry, application of S @ 36 kg/ha recorded the highest dry matter yield (8,528 kg/ha), which was significantly higher than the yield at 24 kg S/ha (~7,700 kg/ha). The trend was similar when the yields were averaged over row spacings/geometry and years; 6,589 kg/ha at 36 kg S/ha and 6,006 kg/ha at 24 kg/ha. *Clearly alfalfa needs 36 kg S/ha.*
- Averaged over S rates and years, missing one row after every two rows had a little bit higher protein content in the first cut (19.5 %) as compared to the other treatments (19.1 or 19.3 %). The second cut protein content (21.3 to 21.5 %) varied little with the treatments.
- Averaged over row spacings/geometry and years, 24 kg S/ha improved the protein content in the first cut by ~2 % points. However, increasing S rate above 24 kg S/ha didn't improve the protein content further. In the second cut, application of S @ 24 to 48 kg S/ha didn't increase the protein content over the check (no S treatment).
- RFV was the highest in both the cuts with application of S @ 24 kg/ha.
- *Making all considerations, alfalfa could be seeded at regular row spacings or by missing alternate rows or preferably by missing one row after every two rows (that gave better yield in 2 out of 3 years) and should be supplied with 36 kg S/ha.*

2.3 Bio Products and Other Agronomic Practices:

√*Effect of EcoTea Seed Treatment on Different Crops (Seeded on May 23, 2023):*

- EcoTea contains plant beneficial microbes and was applied @ 4 g/kg seed.
- EcoTea appeared to increase grain, straw and biomass yield of wheat (*AAC Wheatland*), but not of barley (*CDC Bow*) and canola (*CS2600CRT*).
- Averaged over EcoTea treatments, barley gave the highest grain (3.35 MT/ha), straw (7.24 MT/ha) and biomass (10.59 MT/ha) yields.
- Averaged over crops, EcoTea didn't improve the grain yield and increased the straw and biomass yields only marginally.
- Averaged over 2021-2023, EcoTea considerably increased grain (by 1.22 MT/ha), straw (by 1.32 MT/ha) and biomass (by 2.49 MT/ha) yields of only wheat. Among crops, barley produced the highest grain (3.59 MT/ha), straw (6.66 MT/ha) and biomass (9.80 MT/ha) yields.
- *Farmers are recommended to treat wheat seed with EcoTea for increasing grain yield of wheat.*

√*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.
- Soil applied *Holganix 800⁺* improved the grain yield of winter rye by 0.20 MT/ha, whereas its foliar application increased the winter rye grain yield by 0.73 MT/ha as compared to the check (no *Holganix 800⁺* application). However, these yield increases fell short of the level of significance. Winter wheat in this experiment didn't survive through the winter.

√*Effect of Holganix 800⁺ on Spring Crops (Wheat, Barley and Canola):*

- *Holganix 800⁺* (soil applied at seeding @ 0.625 l/ha) didn't improve the grain, straw and biomass yields of wheat and barley, but considerably increased the canola seed yield by 1.07 MT/ha, straw yield by 2.06 MT/ha and biomass yield by 3.13 MT/ha.
- Averaged over *Holganix 800⁺* treatments (no application and application), canola produced the highest seed (4.51 MT/ha), straw (8.11 MT/ha) and biomass (12.62 MT/ha) yields among the spring crops.

√*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 and FHB disease rating to zero!
- *Stratego* spray increased the grain yield of wheat, barley and oats by 0.79 MT/ha, 0.47 MT/ha and 0.22 MT/ha, respectively.
- Maximum grain yield of barley (6.44 MT/ha) was obtained with *Stratego* and *Prosaro* and that of oats by spraying all the three fungicides (*Stratego*, *Prosaro* and *Caramba*). Wheat grain yield was dismally low in this experiment.
- Maximum straw yield in wheat (5.73 MT/ha) and oats (6.74 MT/ha) was recorded with the spray of *Stratego* and *Prosaro*. Straw yield in barley (4.31 MT/ha) was highest with the spray of all the three fungicides (*Stratego*, *Prosaro* and *Caramba*).
- *Considering both the grain and the straw yields, oats was the best choice out of the three crops.*
- Averaged over fungicides, grain yields were in the order of oats (5.77 MT/ha) = barley (5.74 MT/ha) > wheat (1.55 MT/ha).
- Averaged over crops, grain yield was the lowest (3.94 MT/ha) with the spray of *Stratego* and somewhat higher with the spray of *Stratego* and *Prosaro* both (4.43 MT/ha) and with the spray of all the three fungicides (*Stratego*, *Prosaro* and *Caramba*) - 4.57 MT/ha.
- Averaged over fungicides and years (2020-2023), grain yield was in the order of oats (5.15 MT/ha) > barley (4.02 MT/ha) = wheat (3.97 MT/ha). Straw yield was highest (5.58 MT/ha) with barley; 1.61 MT/ha higher than wheat and 0.67 MT/ha higher than the oats.
- Averaged over crops and years (2020-2023), grain yield wasn't affected much by the fungicides – same without any spray and spray with *Stratego* or both *Stratego* and *Prosaro* (4.28-4.32 MT/ha) and 4.61 MT/ha with the spray of all the three fungicides (*Stratego*, *Prosaro* and *Caramba*), which was only 0.32 MT/ha higher than the no spray. This is because the weather was relatively dry during all these years.
- *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):*

- Fertilizers significantly increased the number of stem/m² in winter rye; however, the increase in plant height and dry matter yield fell short of the level of significance.
- Soil tests in spring 2023 indicated that the fertilizers application to winter rye didn't affect organic matter, pH, ammoniacal N and S, raised the soil P by 1 ppm, and lowered all other nutrient contents (Ca, Mg, K, Cu, B, Mn, Zn and Fe i.e., iron) in the soil and the CEC (Cation Exchange Capacity).
- Fertilizers application to winter rye improved the tissue protein content, Ca, S, K, Cu, Zn, Fe and Mn contents.
- Winter rye was seeded in the fall 2022 and killed by Roundup spray in the spring before seeding the spring crops.

- There was a serious crop damage in this experiment; soybean was eaten by deer, wheat and lentils by birds and barley was heavily infested with an annual grass weed.
- Winter rye with or without fertilizers lowered the grain and biomass yields; though the straw yield wasn't affected.
- Fallow plots (without winter rye cover crop) recorded the highest canola seed yield (6.73 MT/ha). Seed yield after winter rye without and with fertilizers was 6.18 MT/ha and 5.94 MT/ha, respectively.
- Application of fertilizers to winter rye didn't help improving the grain/or seed yield of the following spring crops.

√*Effect of Seeding Dates on Winter Wheat Yield:*

- Winter wheat (cultivar *AAC Gateway*) was seeded on August 30, September 5, September 15, September 25 and October 5.
- Highest grain yield (6.52 MT/ha) was obtained with seeding on September 25 and the highest straw yield (10.7 MT/ha) was obtained by seeding on September 5. Grain yields with seedings on August 30, September 5, September 15 and October 5 were 5.90, 5.83, 4.67 and 5.02 MT/ha, respectively.

√*Evaluation of Combined Cultivation of Sorghum Sudangrass and Alfalfa:*

- Combinations of *Sorghum Sudangrass* and *Alfalfa* at different seeding rates were compared. Only one cut could be taken. Alfalfa was too small to be harvested.
- *Sorghum Sudangrass* seeded at 50, 75 and 100 % of the recommended seeding rate produced similar dry matter yields (4,948 – 5,255 kg/ha).
- *Sorghum Sudangrass* seeded at 100 % of the recommended seeding rate had the highest protein content (20.7 %) and the RFV value (165).

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 and putting new Robot Milk Barns or expanding their Robot Milk Barns. 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 - 44 MT, Kerns barley - 22 MT, Cattlelac barley - 12 MT, Starbuck wheat – 27 MT, 458 bags of corn; 241 bags of Pioneer varieties (P7211AM - 116, P7955AM - 20, P7574 - 24 and P7839 - 81) and 217 bags of Pride varieties (A4414 - 32, A4705HMR – 68 and A4646RIB - 117), and several bags of canola varieties (L350PC, L255PC and L233P) seeds.
- Area farmers continued to diversify their cropping systems! Three farmers (Allan Mol, Ed Breukelman and Lorne Vis) seeded spring wheat for the first time in ~50 acres each. Ryan and Fritz Jaspers seeded winter rye for grain/and straw production for the first time in 95 acres in September end. Bernie Kamphof seeded winter rye to be harvested for forage in May-June 2024 in 85 acres. Winter rye cultivation acts as a cover crop and produces, forage, grain and straw. Gert Brekveld seeded Rednet spring wheat for the first time this year.
- New crop varieties that were grown on Thunder Bay farms were; Starbuck wheat, Synergy and Kerns barley, L350PC canola and several varieties of corn (mentioned in the first bullet point).
- With a new grower, Jim Mol taking to canola cultivation this year, canola acreage continued to increase; current acreage under canola is estimated to be more than 1000 acres in a 25 km radius from LUARS. Canola seed yields were very good and ranged from 1.4 to 1.8 MT/acre.
- Henry and Peter Aalbers grew oats + peas in 50 acres. Their 18 acres better crop yielded 8 MT/acre forage. Dennis Ellchook also seeded oats + peas in 35 acres and got 10 round bales/acre forage yield. Ellchook was very impressed with this crop combination and told that by growing oats +

peas he aimed to lower his grain feed for the dairy cows. All these farmers are going to continue with this crop(s) combination next year too.

- Mike Huber and Jason Reid continued growing Sorghum Sudangrass.
- Ed Breukelman obtained 1.4 MT/acre canola (cultivar L350) seed yield from 85 acres, ~2 MT/acre wheat (cultivar Starbuck) grain yield from 50 acres, 2.65 MT/acre barley (cultivars AAC Synergy and Kerns) grain yield from 120 acres and 20 MT/acre silage corn yield from 50 acres and he left 25 acres corn for grain production.
- Ryan and Fritz Jaspers seeded 195 acres under Synasolis barley (115 acres for grains and 80 acres for silage), 285 acres each under Brandon wheat and L255 and L 356 canola. They grew corn in 35 acres for feed grain production. I believe they got very good yields as usual.
- Gerrit Cramer grew Bonno winter rye in 75 acres that yielded 3 MT grains and 11 bales of straw per acre, which is fairly high yield, 160 acres under AAC Synergy barley with grain yield of 2.25 MT/acre, 160 acres corn (Pioneer varieties) which gave him ~23 MT/acre forage yield, and 150 acres under soybean (Purity Seeds) and obtained 1.4 MT grain yield/acre (1.4 times higher than last year). He also had 100 acres under grass hay and 150 acres under alfalfa (with an estimated yield of 8 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 1.7 MT/acre Starbuck wheat grain yield from 45 acres, 2-4 MT/acre (average 3 MT/acre) grain yield from Cattlelac barley (180 acres), 1.4 MT/acre (cultivar L350)-1.8 MT/acre (cultivar P501) canola seed yield (65 acres), and 23 MT/acre silage corn yield (with 65 % moisture) from 130 acres. They had 190 acres under alfalfa and took three cuts from alfalfa with very good forage yield (~10 MT/acre).
- Richard Templeman grew Liberty canola (cultivar P505MSL) for the third time in 50 acres and obtained 1.50 MT/acre seed yield (higher than what he got last year!). He had 50 acres under Brandon wheat and got reasonably good grain yield (1.7 MT/acre).
- Gert Brekveld grew Starbuck (a high yielding Canadian Western Red Spring wheat variety, recommended by LUARS) wheat in 78 acres, part of which was seeded thin because of under seeding alfalfa with it and got 1.4 MT/acre grain yield. His canola yield from 65 acres too was ~1.4 MT/acre. He got 14.2 MT/acre silage corn yield from 78 acres under corn. Since I had seen his bumper corn crop, I feel Brekveld has under estimated his corn yield.
- Bernie Kamphof didn't harvest any crop this year for grains. He seeded 220 acres under barley, 170 acres under silage corn and 320 acres under alfalfa. All in all, good year! Said Bernie Kamphof.
- Evan Grootenboer seeded 65 acres barley (mostly Esma and some Canmore barley varieties) with 2 MT/acre grain yield, 44 acres corn (Pride Seeds varieties – AS1018G2 EDF RIB and AS1017RR EDF) with a yield of 22 MT/acre with a very good starch content (34 %). Rest of his acres were under alfalfa/grass.
- Mark Veurink seeded 100 acres with Starbuck wheat and obtained 1.8-1.9 MT/acre grain yield. He grew AAC Synergy barley in 85 acres with grain yield of 2.3 MT/acre, canola (Invigor L355PC) in 195 acres, out of which 170 acres were no tilled; with an average canola seed yield of 1.6 MT/acre (higher than that in the last year). Though from the tilled field, he got 1.8 MT/acre canola seed yield. He grew corn in 90 acres out of which 65 acres were kept for feed grain production (expected yield 4 MT/acre) and 25 acres for silage production (20 MT/acre forage yield; 1.6 times more than that from the last year).
- Ben Breukelman seeded 140 acres under L350PC canola that yielded 1.5 MT seeds/acre. He seeded 145 acres under corn, out of which he harvested ~50 acres for grains. His silage corn yield was 18 MT/acre and the grain yield was 4.5 MT/ha. He had barley and alfalfa in more than 100 acres each. He couldn't estimate the yields from these two crops by the time this report was written.
- 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 these record crop yields. Research at LUARS has proved that use of multiple sources of N instead of its single source was conducive to high yields.

- Land clearing and tile drainage on farms continued!
- Mike Huber, John Hayes, Dennis Ellchhook, Bernie Kamphof and Richard Templeman are among those who are applying wood ash in up to 100 acres each.
- 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 11,371 MT grains/and seeds (3,635 MT higher than the last year) from local producers as at November 30, 2023 at a value of \$4,123,844 (a million dollar more 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 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.
- *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! Mark Veurink put a Robot Milking facility at his new barn, and Mark Bolt and Ben Breukelman added new Robots to their Robot Milk Barns!*

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

December 1, 2023