Agriculture Demonstration of Practices and Technologies (ADOPT)

Project Final Report

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

Project Title:	Evaluation of nitrogen stabilizer products in Urea Ammonium Nitrate for wheat and oat
Project Number:	20230495, 20230496,20230497, 20230498, 20230499,20230500, 20230501
Producer Group Sponsoring the Project:	South East Research Farm Indian Head Agricultural Research Foundation East Central Research Foundation Wheatland Conservation Area Conservation Learning Centre Western Applied Research Corporation Northeast Agriculture Research Foundation
Project Location(s): *Provide the name or number of the rural municipality, nearest town or legal land location if possible. Provide the name of any cooperating landowner(s).*	Redvers, Indian Head, Yorkton, Swift Current, Prince Albert, Scott, and Melfort, Saskatchewan
Project start date *(month & year):*	5/1/2024
Project end date *(month & year):*	2/1/2025

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Abstract *(maximum 200 words)*

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

Grain and food companies are launching initiatives to reduce the environmental footprint of grain production on a per-tonne basis, primarily by incentivizing improved nitrogen (N) use efficiency practices. However, humic acid products are not considered to be enhanced efficiency products for government or private industry environmental incentives

programs. As a result, farmers lack adequate information to determine whether the products effectively enhance fertilizer use efficiency. To address this knowledge gap, field trials were conducted at seven locations in Saskatchewan. The study demonstrated six treatments on wheat and oats, using UAN as a nitrogen source applied at 70% of the recommended N rate. Treatments included humic acid alone, humic acid combined with a volatilization (urease) inhibitor, a volatilization inhibitor alone, and a commercially available dual inhibitor (volatilization (urease) + nitrification). For comparison, no-N and UAN-alone treatments were also included as controls. The results indicated significant differences in plant height at three wheat sites and five oat sites, with the control (No N) treatment showing reduced plant heights.

Yield data followed a similar trend, showing significant yield improvements in wheat at four locations where all treatments outperformed the control (No N). In oats, all the treatments increased yield compared to control (No N) at Redvers, Indian Head, and Melfort. At Scott, treatments containing UAN + Volatilization (urease) Inhibitor, UAN + Dual Inhibitor, UAN + Volatilization Inhibitor + Humic, and UAN + Humic alone also resulted in significantly higher yields than untreated UAN and the control (No N). Plant density remained unaffected by all treatments across all locations. The impact of treatments on protein content was generally not significant, except Indian Head and Melfort, where protein content was significantly lower in the control (no N) treatment in both wheat and oats.

Project Objectives

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

To demonstrate and evaluate products for their efficacy in improving nitrogen use efficiency of surface dribble-banded Urea Ammonium Nitrate (UAN)

Project Rationale

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

Farmers have been using humic acid products for years. A Nov 3, 2023 X (Twitter) post by South East Research Farm generated 12,000 views and many referrals to sources of product, and many were using it as a nitrogen efficiency aid. Farmer Danny Ottenbreit of Grayson, SK uses humic acid in a side-band with UAN. According to Doug Grandel with Omex, the most popular form of humic acid is a 12% liquid solution that can either be applied in-furrow as a liquid or applied with a sprayer. Farmer Carlton Fensky of Alberta uses humic acid mixed with UAN to stream in-crop.

Some of the companies carrying humic acid products are Nutrien, Alpine, Omex, SunAlta, Crop Aid, AgSol Canada, Turf Sol, NTS Australia, Evergreen Bio, TopKrop, and Black Earth. Since reducing the waste of nitrogen fertilizer is a shared objective of farmers and society and humic acid fertilizer additive are being marketed as increasing nitrogen use efficiency, an evaluation of the product is needed.

Grain and food companies are launching initiatives to reduce the environmental footprint of grain production on a per-tonne basis. These programs incentivize improved nitrogen use efficiency in oats and canola. Currently, humic acid products are not considered enhanced efficiency products for government or private industry environmental incentives. Farmers lack adequate information to determine whether the products they are using have the desired outcome in fertilizer efficiency in addition to whatever other soil health benefits the products may have. Humic acid may result in increased nitrogen use efficiency and yield while reducing nitrogen losses to the environment. This assessment can be made in comparison with dual inhibitor (NBPT and DMPP) enhanced efficiency N product. NBPT is a urease inhibitor which can reduce the risk of ammonia volatilization in surface applied N while DMPP slows the conversion from ammonium to nitrate, reducing the risk of nitrous oxide emissions and denitrification losses. Humic acid may also have other positive effects on plant growth (i.e., roots) and soil health in addition to its nitrogen-stabilizing effect which will not be the subject of this evaluation.

Wheat and oats were selected for their responsiveness to nitrogen in yield and their reliance on protein levels as a key quality parameter. Products that enhance nitrogen use efficiency can improve yield and protein levels without requiring

increased nitrogen application rates. Because of the food industry's pull for environmental stewardship and carbon efficiency of oats, this is an important and relevant question. Furthermore, the use of UAN is easily adapted to variable rate application, which is part of certain BMP incentive schemes.

The use of dual inhibitor products and variable rate nitrogen application is being incentivized through the OFCAF program of the government of Canada. Farmers are looking for cost-effective and simple means of adding this practice to their farm operations. Because it is liquid, Urea Ammonium Nitrate (UAN) is logistically very easy to adapt to the use of enhanced efficiency products and variable rate application technology with treatment on farm and at a low cost. Humic acid may also have merit as a nitrogen stabilizer. Since humic acid is also suited to be added to UAN, this type of fertilizer and the dribble band application method allows for a comparison of practices in a way that hasn't been demonstrated in ADOPT previously. ARM-U is a liquid form of volatilization inhibitor. ARM-U Advanced is a dual inhibitor that includes a nitrification inhibitor and a urease inhibitor. This product can easily be added to UAN on-farm, making it one of the most accessible methods of incorporating an enhanced efficiency product.

Methodology

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

The demonstration included two randomized complete block trials: One in wheat and the other in oats. Each trial included 6 treatments, totaling 12 treatments across both crop trials, with four replications. Nitrogen treatments involved dribble-banded applications either in-furrow, with a sprayer, or with a custom liquid fertilizer applicator before crop emergence, depending on equipment availability at each site. Ammonium sulfate and monoammonium phosphate were side-banded, with total nitrogen application adjusted for the amounts of N provided by those fertilizers. The nitrogen rate was determined based on recommendations from soil tests at depths of 0-15 cm and 15-60. Fall soil test is used for determining the recommended N rate at all sites except Prince Albert, where spring soil tests were used for determining the recommended N rate.

A soluble liquid humic acid product, Organo Hume (12%) applied at a rate of 3 L per tonne of UAN, was supplied by Omex and distributed to each location. The dual inhibitor product ARM-U Advanced is available as a two-part product, and ARM-U is one of the components, which can also be purchased separately as a urease inhibitor. The active ingredient of the urease inhibitor was N-(n-Butyl) thiophosphoric triamide (NBPT) while that of the nitrification inhibitor was 3,4-Dimethylpyrazole phosphate (DMPP). The inhibitor product were provided by Taurus.

Crop: Wheat and Oats in separate trials

Trt #	Treatment Description	Additive	% of Recommended N
1	Untreated Control	None	70%
2	Volatilization (urease) Inhibitor	ARM-U	70%
3	Dual Inhibitor	ARM-U Advanced	70%
4	Volatilization (urease) Inhibitor + Humic	ARM-U + Humic	70%
5	Humic alone	Humic	70%
6	Control - No N	None	0%

Weather

Table: A Mean Temperature (°C)

Location	Year	May	June	July	August	September	Avg.
		----------Mean Temperature (°C) ----------					
Redvers	2024	10.9	14.7	20.0	17.7	15.8	15.8
	Long term	***11.1***	***16.2***	***18.7***	***18***	***12.5***	***15.3***
Indian Head	2024	10.6	13.6	19.5	17.9	15.9	15.5
	Long term	***10.8***	***15.8***	***18.2***	***17.4***	***11.5***	***14.7***
Prince Albert	2024	8.4	11.3	18.1	15.2	12.7	13.1
	Long term	***11.2***	***16.0***	***18.3***	***16.7***	***11.6***	***14.8***
Swift Current	2024	10.6	14.3	21.3	19.4	16.7	16.5
	Long term	***11.5***	***16.3***	***19.0***	***18.6***	***13.5***	***15.8***
Yorkton	2024	10.5	14.2	20.3	17.7		15.7
	Long term	***10.4***	***15.5***	***17.9***	***17.1***		***15.2***
Melfort	2024	10.1	13.2	19.4	17.4	15.6	15.1
	Long term	***10.1***	***15.2***	***17.8***	***16.7***	***11.7***	***14.3***
Scott	2024	9.8	13.3	18.9	17.4	14.7	14.8
	Long term	***10.8***	***15.3***	***17.1***	***16.5***	***10.4***	***14.0***

Table: B Precipitation (mm)

Location	Year	May	June	July	August	September	Total
		---------- Precipitation (mm) ----------					
Redvers	2024	92	156.2	13.4	39	70.6	371.2
	Long term	***60***	***95.2***	***65.5***	***46.6***	***32.7***	***300***
Indian Head	2024	63.7	74.9	37.4	71.8	44.4	292.2
	Long term	***51.7***	***77.4***	***63.8***	***51.2***	***35.3***	***279.4***
Prince Albert	2024	69.6	118.8	31.4	42.0	27.4	289.2
	Long term	***36.5***	***66.8***	***61.3***	***43.6***	***30.7***	***238.9***
Swift Current	2024	73.6	52.1	18.6	18.2	47.8	210.3
	Long term	***43.4***	***60.5***	***56.4***	***40.4***	***37.3***	***238***
Yorkton	2024	56	120.4	22.9	42.3		241.6
	Long term	***51***	***80***	***78***	***62***		***271***
Melfort	2024	73	84	36.1	31.9	33.8	258.8
	Long term	***33.4***	***79.5***	***69.6***	***45.9***	***36***	***264.4***

Scott	2024	74.2	112.0	26.7	42.8	39.5	295.2
	Long term	***36.3***	***61.8***	***72.1***	***45.7***	***36.0***	***251.9***

The temperature and rainfall patterns had a notable impact on crop performance. While the temperature remained relatively close to the long-term average, the amount of rainfall varied significantly across different regions of the province. In some areas, this led to differing growing conditions and affected the overall progress of agricultural activities. Notably, in Prince Albert, excessive moisture conditions caused delays in seeding operations.

Results *(you must provide the following information)*

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

Plant count:

The plant density was assessed by counting the number of plants within multiple 1-meter row lengths per plot. These measurements were conducted twice at both the front and back sides of each plot, resulting in a total of four observations per plot. These counts were then averaged to obtain a representative value for each plot and the values were subsequently converted into plants per square meter to standardize the results across locations.

Data collected from all seven experimental sites revealed that there was no statistically significant effect of the different treatments on plant density in both wheat and oats.

Plant height

Plant height was recorded from 2-6 plants per plot, with plants assessed on both the fronts and back sides of each plot. The data revealed interesting outcomes, showing significant differences at Redvers, Indian Head and Scott for the wheat crop. The results indicated that all the treatments produced significantly taller plants than control (no N treatment) at Redvers and Indian Head. At Scott, treatments with UAN + Dual Inhibitor, UAN+ Volatilization (urease) inhibitor + Humic, and UAN + Humic alone) were significantly taller than the control (No N) while untreated UAN and UAN + Volatilization (urease) Inhibitors heights were intermediate , not significantly differing from either the shortest or tallest treatment.

Table : 1 Wheat Plant height (cm)

Trt	**Redvers**	**Indian Head**	**Prince Albert**	**Swift Current**	**Yorkton**	**Melfort**	**Scott**
	Wheat Plant height (cm)						
UAN + Untreated Control	85 ^{A}	83 ^{A}	74	66	82	83	82 ^{AB}
UAN + Volatilzation (urease) Inhibitor	87 ^{A}	82 ^{A}	74	69	79	82	89 ^{AB}
UAN + Dual Inhibitor	88 ^{A}	82 ^{A}	76	64	92	83	90 ^{A}
UAN + Volatilization (urease) Inhibitor + Humic	88 ^{A}	84 ^{A}	75	68	90	83	91 ^{A}
UAN + Humic alone	86 ^{A}	82 ^{A}	74	67	94	83	91 ^{A}

Control - No N	75[B]	69[B]	75	67	86	79	79[B]
P value	<0.0001	<0.0001	0.62	0.41	0.63	0.074	0.006

A similar trend was observed in the oats where all the treatments showed significantly taller oats crop plants than control (no N) at Redvers, Indian Head, Prince Albert, and Melfort. While at Scott, treatments (UAN + Volatilization inhibitor + Humic and UAN + Humic) produced significantly taller plants than the remaining treatments and UAN + Volatilization (urease) Inhibitor produced taller plants than the No N control

Table: 2 Oat Plant height (cm)

Trt	**Redvers**	**Indian Head**	**Prince Albert**	**Swift Current**	**Yorkton**	**Melfort**	**Scott**
	Oat Plant height (cm)						
UAN + Untreated Control	101[A]	106[A]	90[A]	72	116	108[A]	100[BC]
UAN + Volatilization (urease) Inhibitor	103[A]	105[A]	81[B]	72	117	108[A]	106[AB]
UAN + Dual Inhibitor	102[A]	108[A]	91[A]	74	116	108[A]	105[ABC]
UAN + Volatilization (urease) Inhibitor + Humic	101[A]	105[A]	90[A]	68	116	110[A]	107[A]
UAN + Humic alone	98[A]	107[A]	88[A]	72	119	107[A]	108[A]
Control - No N	91[B]	87[B]	88[A]	73	111	99[B]	98[C]
P value	0.0002	<0.0001	0.0004	0.410	0.40	0.00016	0.0016

Yield

The plots at all experimental sites were harvested using a small plot combine. Following the harvest, the yield from each plot was calculated and standardized to kilograms per hectare (kg/ha), with adjustments made to normalize the moisture content to 12%. Either the entire harvest sample or a representative dockage sample were cleaned so that yields could be expressed on a clean seed basis. This standardization ensured accurate and comparable yield data across all sites and treatments.

The analysis of the data revealed significant differences in wheat yield at Redvers, Indian Head, Melfort and Scott. At these sites, all treatments demonstrated significantly higher yields compared to the control treatment (no N). The results are presented in Table 3

Table: 3 Wheat Yield (kg/ha)

Trt	Redvers	Indian Head	Prince Albert	Swift Current	Yorkton	Melfort	Scott
	Wheat Yield (kg/ha)						
UAN + Untreated Control	4352 A	4675 A	4281	1385	5081	4885 A	3213 B
UAN + Volatilization (urease) Inhibitor	4440 A	4720 A	4244	1407	4937	4974 A	4009 A
UAN + Dual Inhibitor	4382 A	4773 A	4150	1368	4959	4841 A	3979 A
UAN + Volatilization (urease) Inhibitor + Humic	4072 A	4632 A	4160	1426	5128	4951 A	3987 A
UAN + Humic alone	4005 A	4387 A	4122	1440	4961	4644 A	3930 A
Control - No N	2550 B	2474 B	4193	1333	4674	3466 B	3063 B
P value	<0.0001	<0.0001	0.99	0.52	0.211	<0.0001	0.00019

Similar effect was seen in the Oat crop, where all the treatment resulted in significantly better yield than Control N at Redvers, Indian Head and Melfort. At Scott the treatments (UAN + Volatilization (urease) Inhibitor, UAN + Dual Inhibitor, UAN + Volatilization (urease) Inhibitor + Humic and UAN + Humic alone) resulted in significantly better yield than (UAN+ Untreated control and Control No N). The data is represented in the following table.

Table: 4 Oat Yield (kg/ha)

Trt	Redvers	Indian Head	Prince Albert	Swift Current	Yorkton	Melfort	Scott
	Oat Yield (kg/ha)						
UAN + Untreated Control	5722 A	4497 A	4447	1613 AB	6250	5735 A	3885 B
UAN + Volatilization (urease) Inhibitor	5995 A	4845 A	4476	1651 AB	6126	5733 A	4814 A
UAN + Dual Inhibitor	5699 A	4825 A	4458	1746 A	5824	5828 A	4747 A
UAN + Volatilization (urease) Inhibitor + Humic	5362 A	4815 A	4461	1767 A	6646	5874 A	4772 A
UAN + Humic alone	5231 A	4698 A	4400	1733 A	6440	5961 A	4896 A
Control - No N	3783 B	3269 B	4239	1508 B	5963	4938 B	3782 B
P value	0.0006	0.0012	0.96	0.0006	0.59	0.008	<0.0001

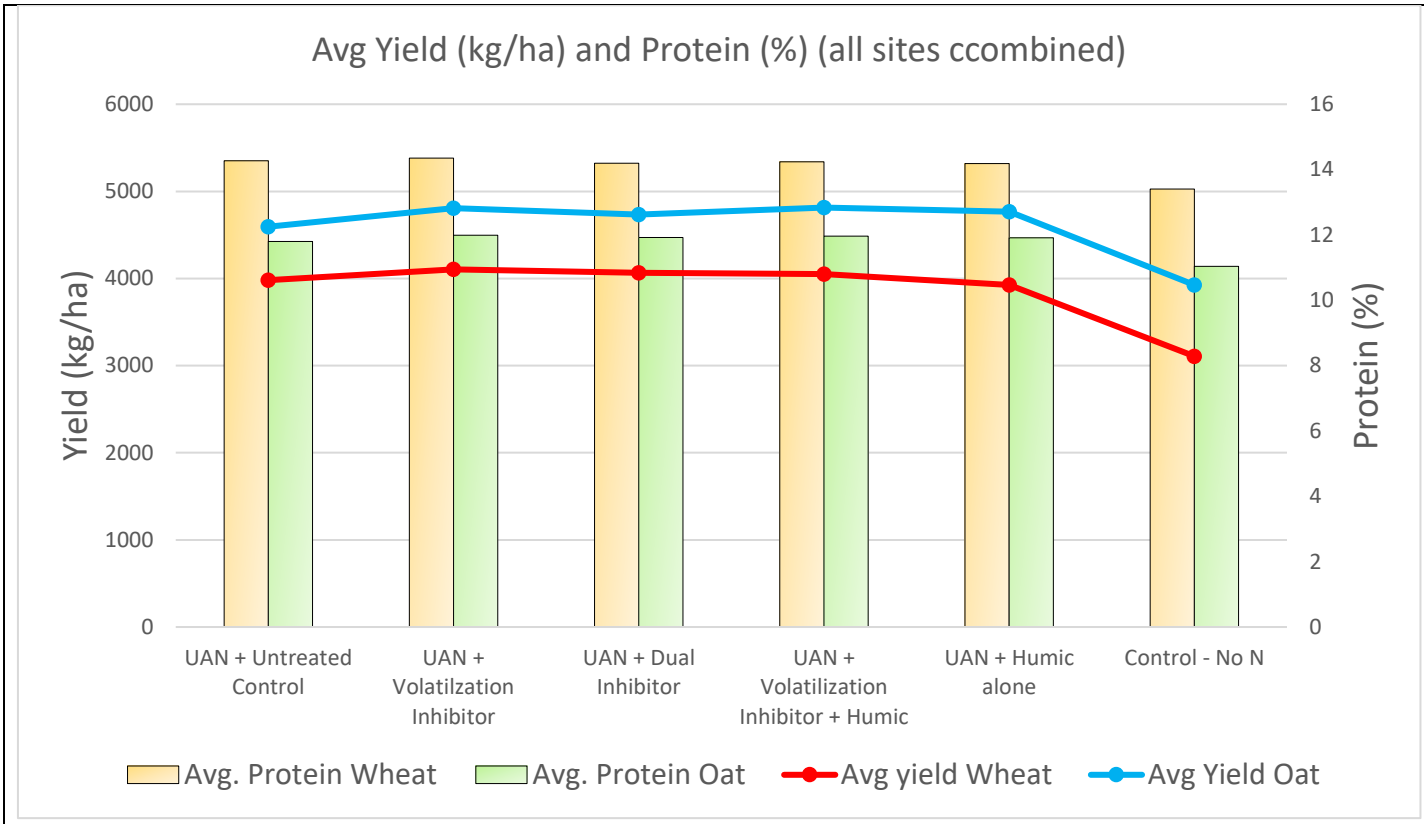

Fig :1

Protein content (%)

The samples were collected after yield calculation, and protein content was calculated on a percentage basis. The results showed a significant effect at Indian head where all the treatments had significantly higher protein content than the control (No N) for both wheat and oats, Similarly at Melfort all the treatment resulted in higher protein content than control (no N) in oats but in wheat, control (no N) resulted in significantly less protein content from (UAN + Volatilization (urease) Inhibitor and UAN + Volatilization (urease) Inhibitor + Humic) but was at par with UAN alone, UAN + Dual Inhibitor and UAN + Humic alone. The protein content in Swift Current was relatively high, a trend often linked to lower yields. Table no. 5 and 6 represent the data across all the sites and figure 1 illustrates the average protein content across various locations.

Table: 5 Wheat Protein (%)

Trt	**Redvers**	**Indian Head**	**Prince Albert**	**Swift Current**	**Yorkton**	**Melfort**	**Scott**
	Wheat Protein (%)						
UAN + Untreated Control	13.5	12.4 ^{A}	13.2	19.4	14.7	13.8 ^{AB}	12.9
UAN + Volatilization (urease) Inhibitor	13.4	12.3 ^{A}	13.2	19.5	15.0	14.1 ^{A}	12.9
UAN + Dual Inhibitor	13.1	12.5 ^{A}	13.6	19.2	14.3	13.6 ^{AB}	13.0

UAN + Volatilization (urease) Inhibitor + Humic	12.5	12.3 [A]	13.3	19.3	15.0	14.0 [A]	13.2
UAN + Humic alone	12.7	12.5 [A]	13.3	19.3	14.7	13.8 [AB]	13.0
Control - No N	13.1	9.4 [B]	13.3	19.1	13.5	12.5 [B]	12.9
P value	0.35	<0.0001	0.26	0.68	0.35	0.012	0.98

Table: 6 Oat Protein (%)

Trt	**Redvers**	**Indian Head**	**Prince Albert**	**Swift Current**	**Yorkton**	**Melfort**	**Scott**
	Oat Protein (%)						
UAN + Untreated Control	10.5	11.8 [A]	13.9	14.4	10.0	8.9 [A]	13.2
UAN + Volatilization (urease) Inhibitor	10.8	11.5 [A]	14.1	14.3	10.2	9.0 [A]	13.9
UAN + Dual Inhibitor	10.9	11.2 [A]	13.7	14.4	10.3	9.2 [A]	13.9
UAN + Volatilization (urease) Inhibitor + Humic	10.8	11.6 [A]	14.0	14.4	9.8	9.3 [A]	13.7
UAN + Humic alone	11.3	11.2 [A]	13.8	14.3	10.1	9.2 [A]	13.6
Control - No N	10.8	8.1 [B]	13.6	13.8	9.8	8.0 [B]	13.3
P value	0.57	<0.0001	0.78	0.04	0.60	0.0001	0.55

Conclusions and Recommendations

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

The analysis of the data parameters revealed noticeable outcomes associated with the use of different nitrogen stabilizer products. These products had a significant impact on plant height and yield. All the treatment at all the experimental sites showed considerably improved results compared to the control plots (no N).

Regarding plant density, the data revealed no statistically significant differences between the treated and control plots across all sites. This indicates that the application of nitrogen stabilizers did not directly impact the number of plants per unit area.

Similarly, the effect of the treatments on protein content was generally insignificant across sites, except for Indian Head and Melfort. At these two locations, the control treatments (without nitrogen) exhibited significantly lower protein content in both wheat and oats compared to the other treatments. This suggests that while nitrogen stabilizers may not consistently influence protein content, they might play a crucial role in maintaining it under certain site-specific conditions.

While the results demonstrated the potential of nitrogen stabilizer products including humic acid, there is a clear need for multiyear data to confirm these findings and draw more definitive conclusions. Variations in environmental conditions, soil properties, and cropping systems from year to year can influence the outcomes, emphasizing the importance of long-term studies.

Sustainable Canadian Agricultural Partnership (Sustainable CAP) Performance Indicators

a) List of performance indicators

Sustainable CAP Indicator	Total Number
Scientific publications from this project (List the publications under section b)	
• Published	N/A
• Accepted for publication	N/A
Highly Qualified Personnel (HQPs) trained during this project	
• Master's students	N/A
• PhD students	N/A
• Post docs	N/A
Knowledge transfer products developed based on this project (presentations, brochures, factsheets, flyers, guides, extension articles, podcasts, videos)[1]. List the knowledge transfer products under section (c)	The trial was presented during field days of all the sites except Prince Albert.

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

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

1.N/A
2.
3.
4.

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

Knowledge Transfer Product or Activity	Event/Location Where Knowledge Transfer Was Conducted	Estimated Number of Producers Participated in Knowledge Transfer	Link (if available)
"Walk the Plots" radio program	Magic 97.1, Country 94.1, CKSW 570	Southwest SK	https://wheatlandconservation.ca/news-events/
C. Holzapfel (IHARF) Plot Tour	Crop Management Field Day, Indian Head, SK (Jul-16-2024)	175	https://iharf.ca/indian-head-crop-management-field-day/
D. Petty (IHARF) Oral Presentation	NCIAF – IHARF Plot Tour, Indian Head, SK (Aug-7-2024)	40	https://nciaf.ca/

Acknowledgements

Include actions taken to acknowledge support by the Ministry of Agriculture, the Canadian Agriculture Partnership (for projects approved between 2017 and 2023) and the Sustainable Canadian Agriculture Partnership (for projects approved between 2023 and 2028).

During field days, support by the Ministry of Agriculture and Sustainable Canadian Agricultural Partnership was acknowledged among the attendees.

Appendices

Identify any changes expected to industry contributions, in-kind support, collaborations or other resources.

Sask Wheat - $3000 per location except Prince Albert, where all the funding was provided by Saskwheat.

Taurus – product support

Omex – product support

Table. I Agronomic information for **Wheat** :

Operations	**Redvers**	**Indian Head**	**Prince Albert**	**Swift Current**	**Yorkton**	**Melfort**	**Scott**
Seeding date	22 May	21 May	14 June	21 May	23 May	16 May	14 May
Previous crop	Canola	Canola	Canola	---	---	---	Canola
Varity	AAC Starbuck	AAC Starbuck	AAC Starbuck	AAC Starbuck	AAC Starbuck	AAC Starbuck	AAC Starbuck
Weed control	Glyphosate @0.7 lt/ac	Glyphosate @0.67 lt/ac on 14 May and 23 May	Roundup Transorb HC @ 1.27L/ha on June 3	Glyphosate @0.67 lt per ac on May 12	Transorb 0.66 l/ac On 12 May	Glyphosate @ 1 lt /ac on 14 May	Glyphosate 540 @ 1L/ac & AIM @ 35 ml/ac On 9 May
In-crop (Agrochemical)	Buctril M 0.4L per acre on 12 June	PrestigeXL @ 0.95 lt + 28g/ac Simplicity on 23 June (herbicide) Sphaerex @ 0.216lt/ac on July 18 (fungicide)	Infinity @ 0.83L/ha on 5 Jul Bravo ZN @ 2.5L/ha on 30 jul	Liquid Achieve @ 0.1L/ac + Buctril M @0.2L/ac on 11 june	Velocity + AMS On 8 jun Axial + AMS On 15 Jun Caramba On 15 July	Enforcer M @ 510 ml/ac on June 9 and July 4, 2024; Axial @ 500 ml/ac on Jun 9, 2024	Axial Xtreme@ 0.5 L/ac & Buctril M @ 0.4 L/ac On 18 Jun Caramba @ 400 ml/ac On 12 Jul
Harvesting date	8 Sep	4 Sep	25 Sep	14 Aug	10 Sep	11 Sep	3 Sep

Table. II Agronomic information for **Oats:**

Operations	**Redvers**	**Indian Head**	**Prince Albert**	**Swift Current**	**Yorkton**	**Melfort**	**Scott**

Seeding date	22 May	21 May	14 June	21 May	23 May	16 May	14 May
Previous crop	Canola	Canola	Canola	---	---	---	Canola
Variety	CDC Arboug	CDC Arboug	CDC Arboug	CDC Arboug	CDC Arboug	CDC Arboug	CDC Arboug
Weed control	Glyphosate @0.7 lt/ac	Glyphosate @0.67 lt/ac on 14 May and 23 May	Roundup Transorb HC @ 1.27L/ha on June 3	Glyphosate @0.67 lt per ac on May 12	Transorb 0.66 l/ac On 12 May and 19 May	Glyphosate @ 1 lt /ac on 14 May	Glyphosate 540 @ 1L/ac & AIM @ 35 ml/ac On 9 May
In-crop (Agrochemical)	N/A	- 0.95 l/ac Prestige XL + 0.5 l/ac Axial applied on June 21, 2024 - 0.4 l/ac Trivepro A and 0.12 l/ac Trivepro B applied on July 9, 2024	Stellar XL @ 1L/ha on 10 Jul	Buctril M @0.4L/ac on 17 June	Prestige On 13 Jun Caramba On 13 Jul	Enforcer M @ 510 ml/ac on June 14	Buctril M @ 0.4 L/ac On 18 Jun Caramba @ 400 ml/ac On 19 Jul
Harvesting date	1 Sep	30 Aug	25 Sep	14 Aug	6 Sep	3 Sep	26 Aug

Soil test:

Nutrient	**Redvers**	**Indian Head**	**Prince Albert**	**Swift Current**	**Yorkton**	**Melfort**	**Scott**
Nitrogen (lb/ac)	39	20.9	86 (0-12”)	34	42 (0-12”)	35	33
Phosphorus (ppm)	8	6	11	8	15	12	12
Potassium (ppm)	203	698	313	187	370	334	297

Expenditure Statement

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

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

Attached