2025 Report

for the

Brewing and Malting Barley Research Institute (BMBRI)

Project Title: Evaluation of nitrogen stabilizer products in Urea Ammonium Nitrate for Malt Barley

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1. **Project Code (as is in contract):** 25-2638

2. **Project Title:** Evaluation of nitrogen stabilizer products in Urea Ammonium Nitrate for Malt Barley

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5. **Abstract/Summary**

Efficient nitrogen (N) management is critical for optimizing yield and quality in malt barley while minimizing environmental losses. A one-year demonstration trial was conducted in 2025 with locations near Redvers and Indian Head, Saskatchewan to assess the performance of humic acid amendments and nitrogen stabilizer products added to surface dribble-banded urea ammonium nitrate (UAN). Treatments included full-rate UAN, reduced-rate UAN (70% of recommended N), urease and dual inhibitor products, humic acid amendments, and an unfertilized control. Two barley cultivars, AAC Synergy and AAC Connect, were evaluated in a randomized complete block design with four replications.

Nitrogen supply strongly influenced crop performance at both locations. Maximum grain yield was achieved with the full recommended N rate, while omission of N fertilizer substantially reduced productivity. Under reduced N input, inhibitor-based treatments maintained yields comparable to untreated UAN at the same rate and, in some instances, numerically approached the full-rate treatment. Responses to humic acid were variable between sites and did not consistently improve upon untreated reduced-rate UAN. Grain protein and test weight were influenced by site conditions and cultivar, with limited and environment-dependent response to nitrogen amendments.

Overall, results indicate that enhanced-efficiency products may help sustain barley performance when nitrogen rates are reduced and N is not banded beneath the soil surface; however, treatment effects were influenced by growing conditions. Additional multi-year evaluation would be required to fully characterize their agronomic and economic benefits.

6. Introduction

Efficient nitrogen (N) management is critical for malt barley production, where both yield and grain quality are closely linked to nitrogen availability. Surface application of liquid nitrogen sources such as Urea Ammonium Nitrate (UAN) is widely used due to its logistical convenience and compatibility with modern application equipment. However, surface-applied UAN is susceptible to nitrogen losses through ammonia (NH_3) volatilization and, following soil incorporation, through nitrification and denitrification pathways. These losses reduce nitrogen use efficiency (NUE), increase production costs, and contribute to environmental concerns associated with nitrogen fertilizer use.

Enhanced efficiency fertilizer products, including urease and nitrification inhibitors, are increasingly promoted as tools to reduce nitrogen losses and improve NUE. In Canada, adoption of these practices is being incentivized through programs such as the On-Farm Climate Action Fund (OFCAF). Farmers are therefore seeking cost-effective, practical solutions that can be readily integrated into existing fertilizer systems. Liquid UAN is particularly well suited for on-farm addition of enhanced efficiency products and for variable-rate nitrogen application, making it an ideal platform for evaluating nitrogen stabilizer technologies under field conditions.

Humic acid products are widely available and have been used by farmers for many years, often with the expectation of improving fertilizer efficiency or crop performance. Most commercial humic acid products are derived from weathered lignite or other organic sources and are marketed as additives to fertilizers and crop protection products. Despite widespread on-farm use and growing commercial interest, there has been limited independent field-scale evaluation of humic acid products for their effectiveness in improving nitrogen use efficiency. Controlled pot and field studies conducted primarily outside Canada have reported reductions in nitrogen losses and yield increases when humic acid was added to urea-based fertilizers. However, results have been variable, and there is a lack of direct comparison between humic acid products and commercially available nitrogen stabilizers under Western Canadian growing conditions.

Interest in humic acid products has increased among producers, agronomists, and retailers. Despite this interest, humic acid products are not currently recognized as enhanced efficiency fertilizers within government or private-sector environmental incentive programs. Farmers therefore lack field-based information to determine whether the use of humic acid products provides measurable improvements in nitrogen efficiency comparable to established urease and nitrification inhibitor technologies.

Dual inhibitor products containing both urease and nitrification inhibitors represent the current standard for reducing nitrogen losses from surface-applied nitrogen fertilizers. ARM-U is a liquid urease inhibitor, while ARM-U Advanced combines urease and nitrification inhibition in a two-part liquid formulation. Both products can be easily added to UAN on-farm, making them practical benchmarks for evaluating alternative nitrogen stabilizer products.

This one-year demonstration trial was conducted by the South East Research Farm (SERF) and the Indian Head Agricultural Research Foundation (IHARF) to evaluate and compare nitrogen stabilizer products added to surface dribble-banded UAN in malt barley. The primary objective of the trial was to demonstrate and assess the efficacy of selected products in improving nitrogen use efficiency relative to untreated UAN, using commercially available urease and dual inhibitor products as reference standards. While humic acid products may provide additional soil or plant health benefits, this evaluation focused specifically on their role as nitrogen stabilizers and their ability to influence crop response and nitrogen efficiency under field conditions.

7. Objectives of the project

To demonstrate and evaluate the efficacy of products in improving nitrogen use efficiency of surface dribble-banded urea ammonium nitrate (UAN) in malting barley.

8. Materials and Methods

Experimental Design and Site Characterization

A one-year demonstration trial was conducted in 2025 at two Agri-ARM research sites: Indian Head (IHARF) and Redvers (SERF). The sites were selected to capture variability in soil properties and agroclimatic conditions and to generate regionally relevant results.

At each site, barley was seeded using a plot seeder at a target rate of 300 seeds m^{-2}. Experiments were arranged in a randomized complete block design (RCBD) with four replications. Treatments were structured as a factorial combination of two barley varieties (AAC Synergy and AAC Connect) and seven nitrogen management strategies (Table 1).

Table 1. List of nitrogen management treatments

#	Nitrogen Treatment	Additive Product	Nitrogen rate (% of Recommended N)
1	Untreated -UAN- High N	None	100%
2	Untreated- UAN-Reduced N	None	70%
3	Urease Inhibitor	ARM-U	70%
4	Dual Inhibitor	ARM-U Advanced	70%
5	Urease Inhibitor + Humic	ARM-U + Humic	70%
6	Humic alone	OrganoHume	70%
7	Control - No N	None	0%

Nitrogen was applied as urea ammonium nitrate (UAN), with treatments differing in application rate (full recommended N rate, 70% of the recommended N rate, or an unfertilized control) and the inclusion of nitrogen-enhancing amendments. At the reduced rate, treatments included urease or dual inhibitors (ARM-U, ARM-U Advanced), humic substances (OrganoHume), or combinations of these products, as detailed in Table 1. All N treatments were surface dribble-banded prior to crop emergence. Inhibitor and humic products were supplied by Omex and Taurus, respectively.

Phosphorus, potassium, and sulfur were applied according to site-specific soil test recommendations to ensure that nutrients other than nitrogen were non-limiting for crop growth and yield.

Site-specific soil, crop management, and weather conditions were documented to provide environmental context for treatment responses. Pre-seeding soil tests characterized baseline soil fertility and chemical properties at each site. Growing-season (May–September 2025) air temperature and precipitation were summarized and compared with long-term site averages using data from nearby weather stations. Seasonal mean air temperatures were similar to long-term averages at both sites, whereas total growing-season precipitation was below the long-term average, particularly at IHARF. Key crop management operations were recorded at each location. Detailed site characterization data are provided in Appendix Table S1.

Data Collection and Measurements

Plant density (plants m^{-2}) was assessed following crop establishment by counting the number of barley plants within two 1-m sections of crop row per plot. Counts were averaged and converted to plants/m^2.

Plant height (cm) was measured by recording the height of six to eight randomly selected plants from two locations within each plot, and the mean plot height was calculated.

Grain protein concentration (%) was measured using near-infrared spectroscopy (NIRS) on a representative grain sample from each plot.

Test weight (g /0.5L) was determined by weighing a 0.5-L clean grain sample following standard Canadian Grain Commission procedures.

Grain yield was determined at crop maturity and expressed on an area basis (kg/ha). Yield values were adjusted to a standard grain moisture content of 13.5%.

9. Results

Plant density

Across the two sites, plant density did not differ significantly between the two barley varieties ($P > 0.05$, Tables 2 and 3), indicating similar establishment of AAC Synergy and AAC Connect across nitrogen management strategies. Mean plant density was higher at IHARF than at SERF (202 vs. 139 plants/m^2), reflecting more favorable establishment conditions at IHARF.

At IHARF, plant density differed among nitrogen treatments ($P = 0.0262$, Table 2); however, mean comparisons using Tukey's HSD test did not reveal significant differences at $\alpha = 0.05$, indicating that differences among treatments were small. Similarly, at SERF, no significant differences in plant density were observed among nitrogen treatments ($P = 0.5738$, Table 3).

Overall, these results indicate adequate and relatively uniform crop establishment across barley varieties and nitrogen treatments at both sites.

Table 2. Effects of barley cultivar and nitrogen management strategy on crop growth, grain yield, and quality parameters at IHARF (Indian Head, SK) in 2025.

Treatment	Plant Density (plants/m2)		Plant height (cm)		Test weight (g/0.5L)		Protein (%)		Yield (kg/ha)	
Variety (V)										
AAC Synergy	207.9		69.5	A	345.1		10.6	B	6124.8	A
AAC Connect	197.8		65.4	B	345.0		11.2	A	5762.1	B
p-value	0.0847		0.000		0.6914		0.000		0.000	
Nitrogen treatment (N)										
Untreated UAN – High N	206.1	A	71.4	A	347.1	A	11.8	A	6545.9	A
Untreated UAN	189.7	A	68.8	AB	346.5	A	11.4	AB	6183.5	AB
Urease Inhibitor	207.9	A	67.4	B	345.5	A	11.0	B	6103.8	B
Dual Inhibitor	181.1	A	67.9	B	346.2	A	11.3	AB	6205.2	AB
Urease Inhibitor + Humic	210.2	A	68.5	AB	345.5	A	11.2	AB	6187.8	AB
Humic	214.1	A	68.1	B	345.3	A	11.0	B	6041.5	B
Control - No N	210.8	A	60.3	C	339.3	B	8.6	C	4336.2	C
p-value	0.0262		0.000		0.000		0.000		0.000	
V x N										
p-value	0.733		0.2611		0.001		0.759		0.0847	
Grand Mean	202.8		67.5		345.1		10.9		5943.4	
CV	10.5		3.1		0.4		3.6		4.6	

Plant height

At IHARF, barley variety had a significant effect on plant height ($P < 0.01$, Table 2), with AAC Synergy taller than AAC Connect (69.5 vs. 65.4 cm). Nitrogen treatment also significantly influenced plant height ($P < 0.01$). The tallest plants were observed in plots receiving full-rate UAN (71.4 cm), while the unfertilized control produced the shortest plants (60.3 cm). Plots receiving 70% N, either alone or with urease inhibitor plus humic amendments, exhibited heights comparable to the full-rate UAN treatment. No significant variety × nitrogen interaction was observed ($P = 0.261$, Table S2), suggesting that varietal responses to nitrogen treatments were consistent.

At SERF, barley variety did not significantly influence plant height ($P = 0.598$, Table 3). Similar to IHARF, AAC Synergy was taller than AAC Connect (71.7 vs. 69.6 cm), reflecting genetic growth differences. Nitrogen treatment also had no statistically significant effect ($P = 0.233$), though numerical differences were evident. The tallest plants were observed in plots receiving 70% N with urease inhibitor or untreated 70% N (78.5 and 77.1 cm, respectively), while the unfertilized control or plots receiving UAN with humic amendments were shorter. No significant variety × nitrogen interactions were detected (P = 0.328, Table S3).

Across both sites, plant height reflected both varietal growth potential and nitrogen availability. Full-rate UAN frequently supported taller plants at IHARF, while reduced nitrogen rates combined with urease inhibitor, alone or with humic amendments, produced comparable growth, highlighting the potential of these products to maintain vegetative development at reduced N rates. Height at Redvers was more variable and not significantly affected by the N treatments but tended to be lower in the control. Overall, these results suggest a site-specific response to enhanced-efficiency products and humic amendments.

Table 3. Effects of barley cultivar and nitrogen management strategy on crop growth, grain yield, and quality parameters at SERF (Redvers, SK) in 2025.

Treatment	Plant Density (plants/m2)	Plant height (cm)	Test weight (g/0.5L)		Protein (%)		Yield (kg/ha)	
Variety (V)								
AAC Synergy	135.6	71.7	225.7	A	10.1	B	3758.2	A
AAC Connect	144.3	69.6	221.1	B	10.5	A	3491.9	B
p-value	0.2604	0.598	0.0016		0.002		0.027	
Nitrogen treatment (N)								
Untreated UAN – High N	136.6	73.1	225.1		10.4		4225.6	A
Untreated UAN	147.2	77.1	220.9		10.4		3635.0	AB
Urease Inhibitor	143.1	78.5	226.9		10.2		3751.1	AB
Dual Inhibitor	142.1	70.4	222.8		10.3		3932.3	AB
Urease Inhibitor + Humic	149.1	65.6	224.0		10.2		3474.3	B
Humic	139.6	68.9	223.5		10.2		3795.3	AB
Control - No N	121.8	61.1	220.5		10.3		2561.6	C
p-value	0.5738	0.233	0.157		0.948		0.000	
V x N								
p-value	0.1984	0.3279	0.9881		0.9413		0.9852	
Grand Mean	139.9	70.7	223.4		10.3		3625.0	
CV	20.4	20.8	2.2		4.7		11.9	

Grain protein

At IHARF, barley variety significantly influenced grain protein ($P < 0.01$, Table 2), with AAC Connect producing higher protein than AAC Synergy (11.2 vs. 10.6%). Nitrogen treatment also had a significant effect ($P < 0.01$). The highest protein was observed in the full-rate UAN treatment (11.8%), while the unfertilized control had the lowest (8.6%). Plots receiving 70% N, alone or with the dual inhibitor, produced protein concentrations comparable to the full-rate UAN treatment.

At SERF, barley variety also significantly influenced grain protein (P = 0.002, Table 3), with AAC Connect slightly higher than AAC Synergy (10.5 vs. 10.1%). In contrast, nitrogen treatment did not have a statistically significant effect (P = 0.948). Protein levels were relatively uniform across N treatments (10.2–10.4%), with the unfertilized control comparable to N-fertilized plots.

No significant variety × nitrogen interactions were detected (P = 0.759 and 0.941 for IHARF and SERF, respectively, Table S2 and S3), indicating that varietal responses were consistent across nitrogen treatments.

Across both sites, grain protein reflected both varietal potential and site-specific responsiveness to nitrogen (Tables 2 and 3). Full-rate UAN consistently increased protein at IHARF, while reduced N rates, alone or with dual inhibitors, frequently maintained protein levels comparable to the full-rate UAN, demonstrating potential to maintain grain quality under reduced nitrogen input. Notably, high protein is not a desirable trait in malting barley but does have value in feed markets.

Test weight

At IHARF, test weight did not significantly differ between barley varieties (P = 0.691, Table 2), with AAC Synergy and AAC Connect producing nearly identical values (345.1 vs. 345.0 g/0.5 L). In contrast, nitrogen treatment had a significant effect (P < 0.001). The highest test weight was observed in the full-rate UAN treatment (347.1 g/0.5 L), while the unfertilized control had the lowest (339.3 g/0.5 L). Other nitrogen treatments, including 70% N with or without inhibitors or humic amendments, produced comparable test weights to the full-rate UAN treatment. A significant variety × nitrogen interaction was detected (P = 0.001, Table S2), indicating some differential response of varieties to nitrogen treatments at this site.

At SERF, barley variety significantly affected test weight (P = 0.002, Table 3), with AAC Synergy producing slightly higher test weight than AAC Connect (225.7 vs. 221.1 g/0.5 L). Nitrogen treatments did not result in statistically significant differences (P = 0.157). Although numerical variation was observed among treatments, it appeared to be random. No significant variety × nitrogen interaction was detected (P = 0.988, Table S3). Test weights at SERF was substantially lower than at IHARF and below the industry standard of approximately 309 g/0.5 L. This reduction is likely attributable to pre-harvest sprouting (PHS) that occurred approximately one week prior to harvest (Figure 1), which would have negatively affected kernel integrity and bulk density across treatments.

While interpretation of test weight response to nitrogen management at SERF was complicated by a pre-harvest sprouting event, it is reasonable to conclude that full-rate UAN generally supported greater test weight, whereas reduced N rates, with or without enhanced-efficiency products or humic amendments, maintained values comparable to the full-rate treatment. These findings suggest that modest reductions in N rate are unlikely to have any major impacts on test weight under conditions where grain filling is not limited by environmental stress.

Figure 1. Pre-harvest sprouting observed in AAC Synergy and AAC Connect at SERF (Redvers, SK) approximately one week prior to harvest in 2025.

Grain yield

Grain yield was significantly influenced by barley variety at both sites. AAC Synergy outyielded AAC Connect at IHARF (6125 vs. 5762 kg/ha; $P < 0.01$) and at SERF (3758 vs. 3492 kg/ha; $P = 0.027$), indicating superior yield potential across contrasting environments (Tables 2 and 3).

Nitrogen management had a pronounced effect on yield at both locations ($P < 0.01$, Tables 2 and 3). At both sites, full-rate UAN produced the highest yield (6546 and 4226 kg/ha at IHARF and SERF, respectively), while the unfertilized control resulted in substantially lower yields (4336 and 2562 kg/ha, respectively). Across both environments, the dual inhibitor treatment ranked second in yield, following the full-rate treatment, suggesting potential for improved yield retention under reduced nitrogen input.

Responses of humic-based treatments were more inconclusive with no significant impacts relative to untreated UAN at the same rate and no consistent trends observed.

No significant variety × nitrogen interactions were detected at either site ($P = 0.0847$ and 0.9852 for IHARF and SERF, respectively; Table S2 and S3), indicating consistent varietal responses across nitrogen treatments.

Overall, grain yield was strongly influenced by nitrogen rate at both sites (Tables 2 and 3). Full-rate UAN produced the highest yields, confirming the importance of nitrogen availability in malt barley production. Among reduced-rate treatments (70% of recommended N), the dual inhibitor consistently ranked among the highest yielding treatments and maintained yields comparable to the full-rate treatment; however, it did not statistically exceed the untreated 70% UAN treatment. Humic-based treatments did not consistently outperform untreated UAN at the same nitrogen rate. These results indicate that while enhanced-efficiency products may help sustain yield under reduced nitrogen inputs, their performance relative to untreated 70% UAN was variable under the environmental conditions of 2025 at IHARF and SERF. Importantly, results may differ if the N had been banded beneath soil as would be the case with sideband or mid-row band placement.

10. Conclusions

This one-year demonstration trial evaluated the efficacy of nitrogen stabilizer products added to surface dribble-banded UAN in malt barley under contrasting environmental conditions at Indian Head and Redvers in 2025.

Nitrogen rate was the primary driver of crop performance at both sites. Full-rate UAN consistently produced the highest grain yield and, at IHARF, the highest grain protein concentration. The unfertilized control resulted in substantially lower yield, confirming that nitrogen availability was a key limiting factor in both environments.

Among reduced-rate treatments (70% of recommended N), the dual inhibitor treatment consistently ranked among the highest-yielding reduced-rate treatments at both sites and produced yields numerically closest to the full-rate UAN treatment. However, yields from enhanced-efficiency treatments did not consistently differ statistically from untreated UAN applied at the same reduced rate.

Humic acid treatments exhibited variable responses between sites and did not consistently outperform untreated UAN at same nitrogen rates. While humic amendments did not negatively impact crop performance, their effectiveness as nitrogen stabilizers was not consistently demonstrated relative to commercially available urease or dual inhibitor products.

Grain protein and test weight responses were influenced by nitrogen rate and site conditions. At IHARF, full-rate UAN increased protein concentration, while reduced-rate treatments generally maintained protein within a similar range. At SERF, nitrogen treatments had minimal effect on protein concentration, suggesting environmental limitations to nitrogen uptake or expression of protein response. Test weight responses were generally consistent across reduced-rate treatments and did not indicate quality penalties associated with the use of enhanced-efficiency products.

Overall, results from this demonstration indicate that dual inhibitor products may help sustain yield when nitrogen rates are reduced, particularly under conditions favorable for nitrogen loss. However, clear and consistent improvements in nitrogen use efficiency relative to untreated UAN at the same nitrogen rate were not observed. Responses to humic acid products were inconsistent, and may be influenced by environmental conditions.

As a single-year evaluation, these findings reflect the environmental conditions of 2025 and should not be generalized beyond similar production environments. Multi-year assessment and combined statistical analyses would be required to fully characterize the agronomic and economic value of these products under variable climatic conditions.

11. Technology transfer activities

This project was showcased during the growing season at the annual field days at both locations.

12. 1. Funding contributions & Acknowledgements

This project was supported by BMBRI funding. The project team gratefully acknowledges this support, which made the multi-site demonstration possible. We thank Omex and Taurus for supplying the inhibitor and humic acid products as in-kind support for this demonstration trial.

13. Appendix

Table S1. Site-specific soil properties, weather conditions, and crop management during the 2025 growing season at the IHARF and SERF field sites.

A. Soil properties (pre-seeding)

Parameter	Depth	IHARF	SERF
N (lb/ac)	0–6 in	6.0	12
	6–24 in	12.0	15
	0–24 in	18	27
P (ppm)	0–6 in	13.0	8
K (ppm)	0–6 in	780	153
S (lb/ac)	0–6 in	11.2	> 120
	6–24 in	26.9	> 360
Organic matter (%)	0–6 in	5.3	2.7
pH	0–6 in	7.7	8
	6–24 in	8.2	8.4
Electrical conductivity (mmho/cm)	0–6 in	0.58	0.73
	6–24 in	0.58	1.86

B. Weather conditions

Mean monthly air temperature (°C)

Month	2025 IHARF	Long-term IHARF	2025 SERF	Long-term SERF
May	12.7	10.8	13.2	11.1
June	15.3	15.8	16.2	16.2
July	17.0	18.2	17.5	18.7
August	17.8	17.4	17.9	18
September			14.9	12.5
Seasonal mean	15.7	15.6	15.9	15.3

Monthly precipitation (mm)

Month	2025 IHARF	Long-term IHARF	2025 SERF	Long-term SERF
May	42.6	51.7	65	60
June	39.4	77.4	27	95.2
July	27.1	63.8	80	65.5
August	26.9	51.2	40	46.6
September			48	32.7
Seasonal total	136.0	244.1	260	300

C. Key field operations

Operation	IHARF date	SERF date
Seeding	23-May-25	29-May-25
Pre-emergent/seeding herbicide	Roundup WeatherMax (0.67 l/ac), May 13	Roundup 540 (0.67 l + Water 40 l/ac), May 26
Post-emergent weed control	0.95 l/ac Prestige XL + 0.5 l/ac Axial applied on June 16	Buctril M (0.4 L + Water 40L/ac), June 11
Fungicide and/or Insecticide applications	0.4 l/ac Trivepro A and 0.12 l/ac Trivepro B, July 5	NA
Harvest	28-Aug-25	22-Sep-25

Table S2. Individual treatment means for crop growth, grain yield, and grain quality responses of two barley varieties to various nitrogen management strategies at IHARF, Indian Head, Saskatchewan, 2025.

Treatment		Plant Density (plants/m2)	Plant height (cm)	Test weight (g/0.5L)		Protein (%)	Yield (kg/ha)
Variety	Nitrogen treatment (N)						
AAC Synergy	Untreated UAN – High N	212.4	73.0	347.1	A	11.3	6600.5
	Untreated UAN	191.5	71.2	347.4	A	11.2	6562.3
	Urease Inhibitor	218.6	70.1	346.1	A	10.8	6337.3
	Dual Inhibitor	190.3	71.4	346.6	A	11.0	6494.7
	Urease Inhibitor + Humic	221.5	70.4	346.1	A	11.0	6421.7
	Humic	212.9	69.7	345.2	A	10.8	6095.0
	Control - No N	207.9	61.1	337.4	C	8.3	4362.0
AAC Connect	Untreated UAN – High N	199.7	69.8	347.1	A	12.2	6491.3
	Untreated UAN	187.9	66.3	345.7	A	11.6	5804.7
	Urease Inhibitor	197.3	64.8	344.8	A	11.2	5870.3
	Dual Inhibitor	171.8	64.4	345.9	A	11.6	5915.8
	Urease Inhibitor + Humic	198.9	66.5	345.0	A	11.4	5953.9
	Humic	215.3	66.4	345.4	A	11.2	5988.1
	Control - No N	213.7	59.5	341.2	B	9.0	4310.4
p-value		0.733	0.2611	0.001		0.759	0.0847
Grand Mean		202.8	67.5	345.1		10.9	5943.4
CV		10.5	3.1	0.4		3.6	4.6

Table S3. Individual treatment means for crop growth, grain yield, and grain quality responses of two barley varieties to various nitrogen management strategies at SERF, Redvers, Saskatchewan, 2025.

Treatment		**Plant Density (plants/m2)**	**Plant height (cm)**	**Test weight (g/0.5L)**	**Protein (%)**	**Yield (kg/ha)**
Variety	**Nitrogen treatment (N)**					
AAC Synergy	Untreated UAN – High N	114.9	74.8	227.2	10.1	4316.9
	Untreated UAN	147.7	87.6	222.1	10.0	3715.9
	Urease Inhibitor	146.0	69.7	230.1	10.0	3972.6
	Dual Inhibitor	126.8	72.5	224.8	10.2	3999.9
	Urease Inhibitor + Humic	142.7	64.0	226.0	10.0	3591.9
	Humic	155.8	70.5	226.0	10.1	4005.0
	Control - No N	115.3	63.0	223.4	10.0	2705.0
AAC Connect	Untreated UAN – High N	158.3	71.5	223.0	10.7	4134.4
	Untreated UAN	146.8	66.7	219.7	10.7	3554.0
	Urease Inhibitor	140.3	87.3	223.8	10.5	3529.7
	Dual Inhibitor	157.5	68.3	220.9	10.5	3864.6
	Urease Inhibitor + Humic	155.5	67.1	221.9	10.5	3356.7
	Humic	123.5	67.3	221.0	10.3	3585.7
	Control - No N	128.4	59.2	217.5	10.5	2418.2
p-value		0.1984	0.3279	0.9881	0.9413	0.9852
Grand Mean		139.9	70.7	223.4	10.3	3625.0
CV		20.4	20.8	2.2	4.7	11.9