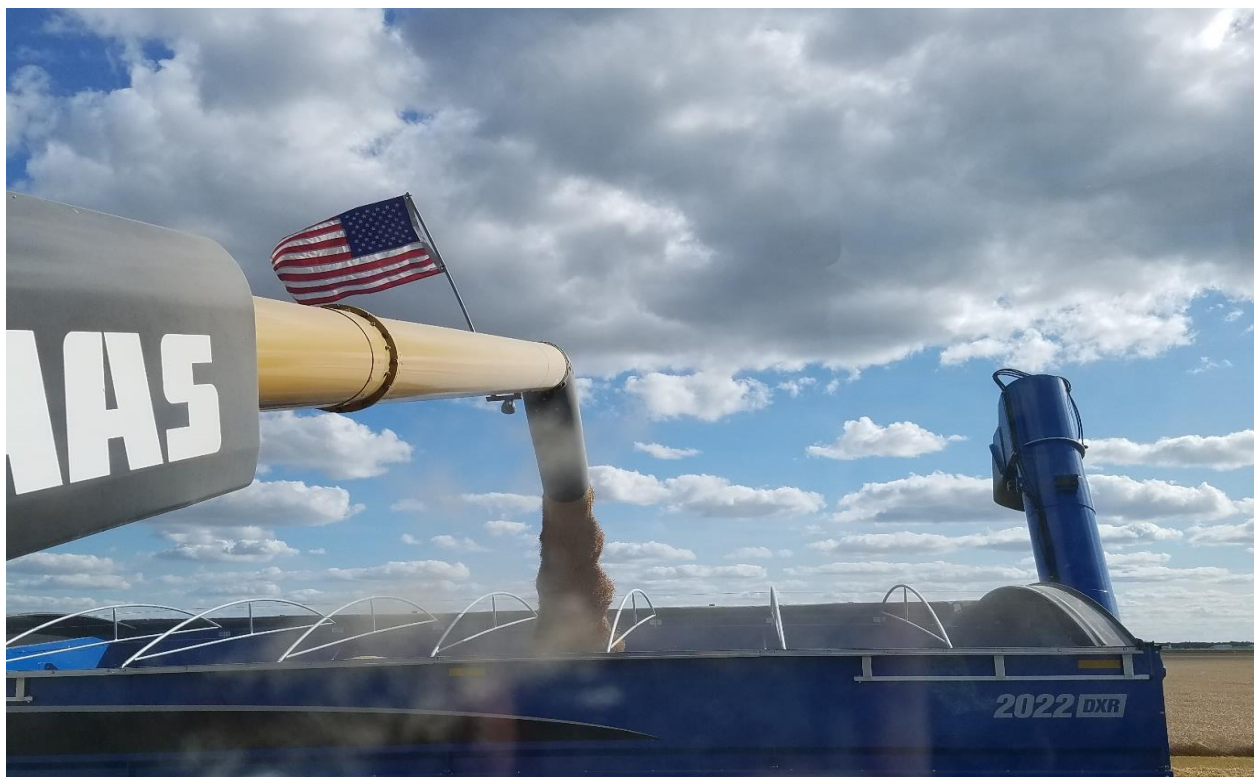


MN Wheat On-Farm Research Network 2019 Report



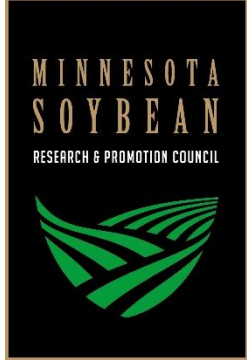
ON-FARM RESEARCH
— NETWORK —
MINNESOTA WHEAT



MINNESOTA WHEAT
RESEARCH & PROMOTION COUNCIL

mi DEPARTMENT OF
AGRICULTURE

AFREC
Agricultural Fertilizer Research & Education Council



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The willingness and excitement of the growers and others who have been in the OFRN keeps the research moving forward. Without willing producers looking to improve production in their operations this Network would not continue. Thank you to all our past participants and others for your contributions!

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Seeding Rate

Objective

Determine the optimum seeding rate for various hard red spring wheat varieties currently grown in MN.

Years of Study

2016-2019

Treatments

Seeding rates of 1.0, 1.5, and 2.0 million live seeds per acre tested on various spring wheat varieties

Methods

- Trials included three replications of the three seeding rates at six locations in 2019, however only five were harvested due to poor harvest conditions.
- Varieties used in 2019 were Shelly and WB 9590. Previous years also studied Bolles, Lang-MN, Linkert, Shelly, and SY Valda. A total of 32 locations from 2016-2019 are included in the combined analysis.
- Plots were established and harvested with producer equipment. One plot is typically one to two passes of the planter wide by the full length of the field.
- At harvest, one combine pass from each plot is weighed in a weigh wagon or a grain cart at harvest and the grain is sampled to test moisture content, test weight, and protein content.
- The established stand and the number of spikes per acre were counted during the growing season to calculate in-season stand loss and tillering capacity of each variety.
- All statistical analyses were conducted at the 90% confidence level
- Additional data not shown in this report are available at <https://mnwheat.org/farm-research-network/>.

Results

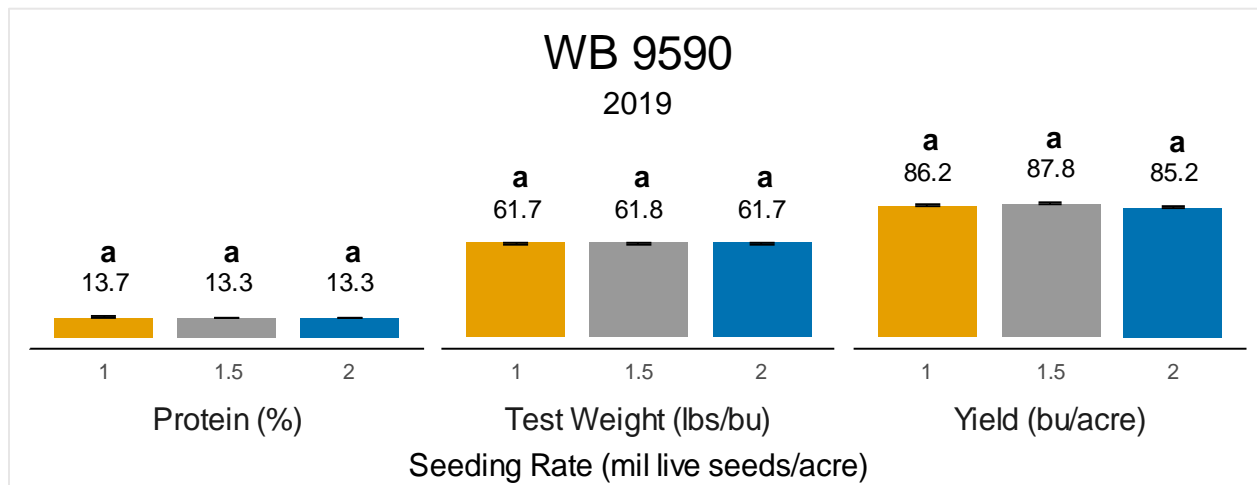


Figure 1. Harvest results from two combined WB 9590 locations in 2019. Differing letters indicate differences among treatments at the 90% confidence level.

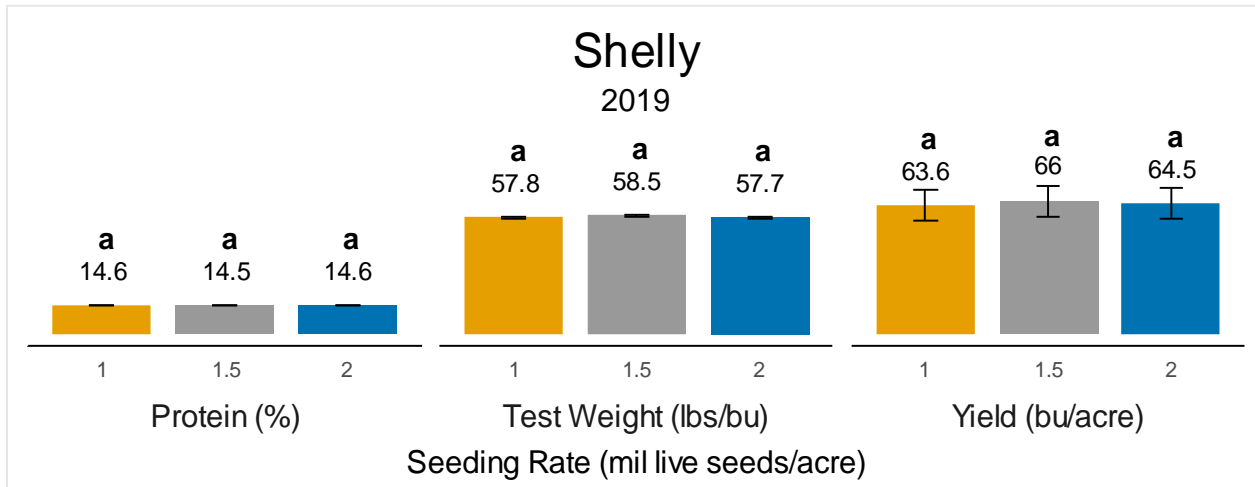


Figure 2. Harvest results from two combined Shelly locations in 2019. Differing letters indicate differences among treatments at the 90% confidence level.

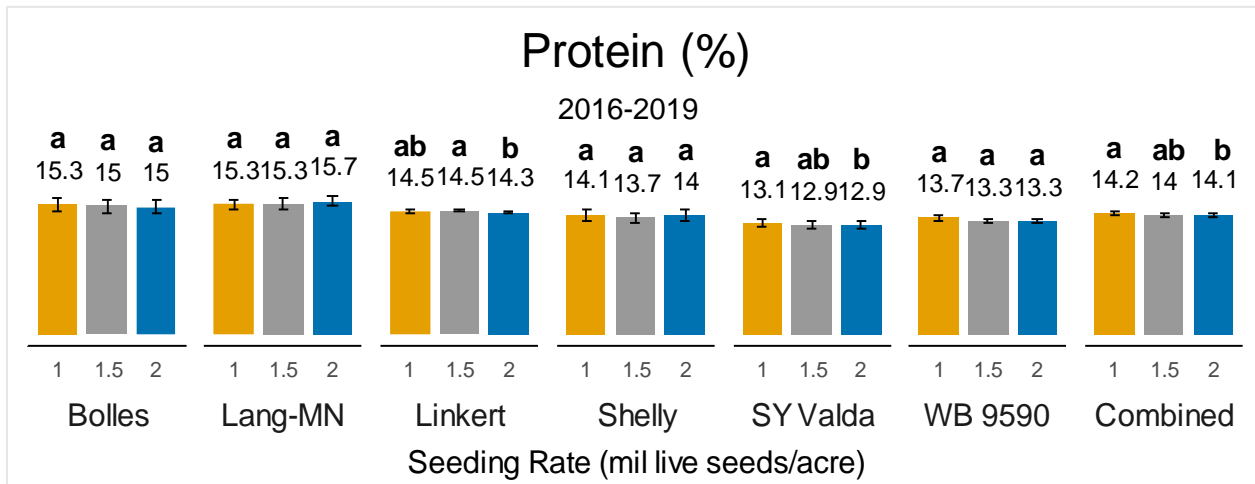


Figure 3. Protein content for individual varieties and combined across all locations from 2016-2019. Differing letters indicate differences among treatments within each variety at the 90% confidence level. The number of locations included in the combined analysis for each variety were: Bolles – 4, Lang-MN – 3, Linkert – 10, Shelly – 5, WB 9590 – 2, and Combined – 32.

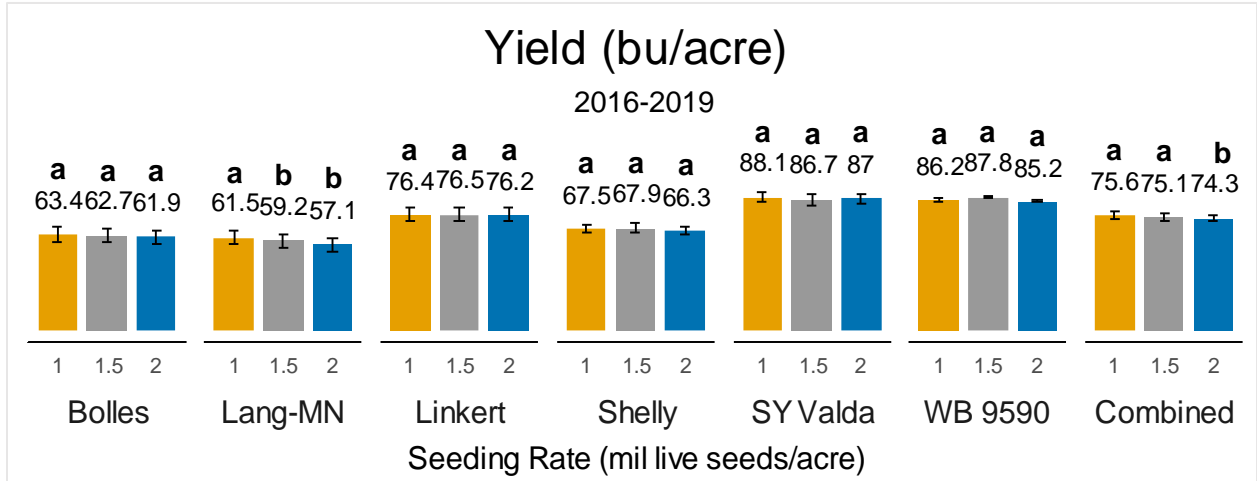


Figure 4. Yield for individual varieties and combined across all locations from 2016-2019. Differing letters indicate differences among treatments within each variety at the 90% confidence level. The number of locations included in the combined analysis for each variety were: Bolles – 4, Lang-MN – 3, Linkert – 10, Shelly – 5, WB 9590 – 2, and Combined – 32.

Table 1. Partial profit analysis of seeding rate yield from combined locations from Figure 4.

Seeding Rate mil seeds/acre	Seed Cost ¹ \$/acre	Yield bu/acre	Net Revenue	
			Gross Revenue \$/acre	\$/acre
1	\$ 16.67	75.6	\$ 389.34	\$ 372.67
1.5	\$ 25.00	75.1	\$ 386.77	\$ 361.77
2	\$ 33.33	74.3	\$ 382.65	\$ 349.31

1 Certified seed cost at \$0.20 per lb

2 Estimated based on an average of 12,000 seeds per lb

3 Based on price of \$5.15 per bu

Conclusions

- There were no differences in protein content, test weight, or yield for the 2019 varieties.
- Yield was 1.3 bu greater with the lowest seeding rate compared to the highest seeding rate when combined across all locations and varieties (Figure 4).
- Protein was either not different or 0.1-2% greater with the lowest seeding rate compared to the highest seeding rate for individual varieties and when combined (Figure 3).
- Tillering capacity increased as seeding rate decreased, resulting in a similar number of total harvested heads per acre among treatments (data not shown).

Flag Leaf Fungicide

Objective

Determine the effect of adding fungicide application at the flag leaf growth stage on yield and protein.

Years of Study

2018-2021

Treatments

See Table 2 below

Methods

- Treated plots included an additional fungicide application at the flag leaf growth stage, in addition to the control applications at the 4-5 leaf and flowering growth stages. Treatment details are outlined below in Table 2.
- Treatments were replicated four times at eight locations in 2019, however only six were harvested due to poor harvest conditions. A total of 11 locations from 2018-2019 are included in the combined analysis.
- Varieties used in 2019 were WB 9590, TCG Spitfire, SY Valda, and WB Mayville.
- Plots were established and harvested with producer equipment. One plot is typically one to two passes of the application equipment wide by the full length of the field.
- At harvest, one combine pass from each plot is weighed in a weigh wagon or a grain cart at harvest and the grain is sampled to test moisture content, test weight, and protein content.
- All statistical analyses were conducted at the 90% confidence level
- Data not shown in this report are available at <https://mnwheat.org/farm-research-network/>

Table 2. Treatments for the flag leaf fungicide trial.

Growth Stage	Treatment	Control
4-5 leaf (2 oz/acre) ¹	(propiconazole) Priaxor	(propiconazole)
Flag leaf (2 oz/acre)	(fluxapyroxad+pyraclostrobin) Prosaro	None Prosaro
Early flowering (6.5 oz/acre) ²	(prothioconazole+tebuconazole)	(prothioconazole+tebuconazole)

1 Two locations in 2019 used Alto (cyproconazole) at 2 oz per acre
 2 Two locations in 2019 used Miravis Ace (propiconazole+pydiflumetofen) at 13.7 oz/acre

Results

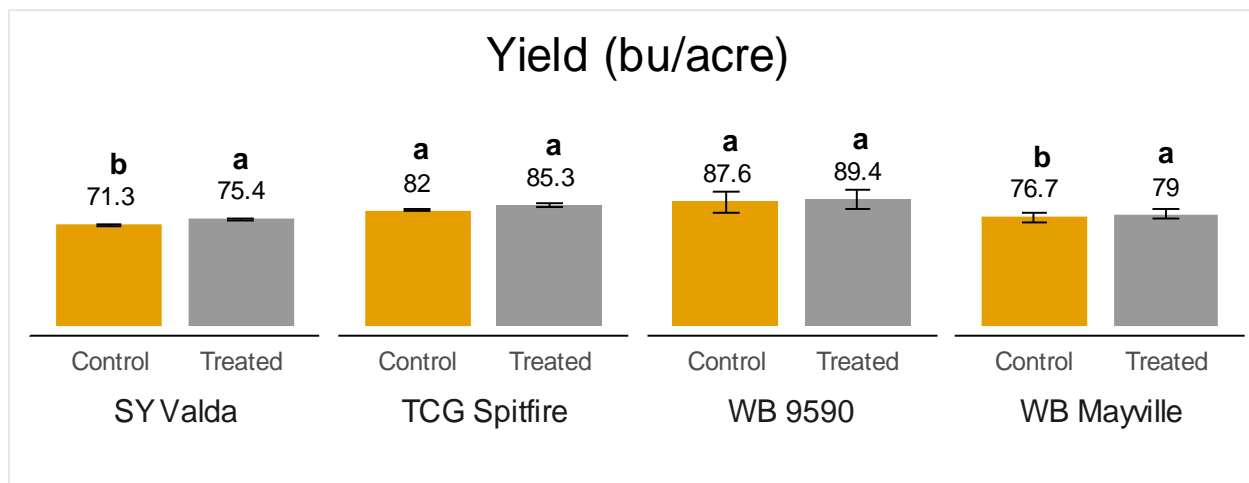


Figure 5. Yield for individual varieties and combined across locations from 2018-2019. Differing letters indicate differences among treatments within each variety at the 90% confidence level. The number of locations included in the combined analysis for each variety were: SY Valda – 1, TCG Spitfire – 2, WB 9590 – 2, WB Mayville – 6.

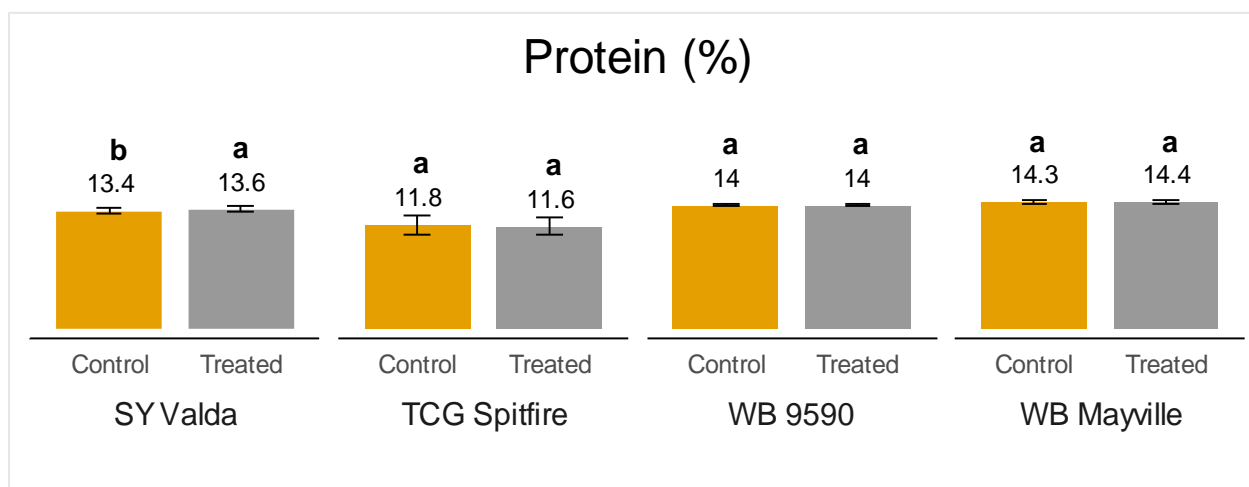


Figure 6. Protein content for individual varieties and combined across locations from 2018-2019. Differing letters indicate differences among treatments within each variety at the 90% confidence level. The number of locations included in the combined analysis for each variety were: SY Valda – 1, TCG Spitfire – 2, WB 9590 – 2, WB Mayville – 6.

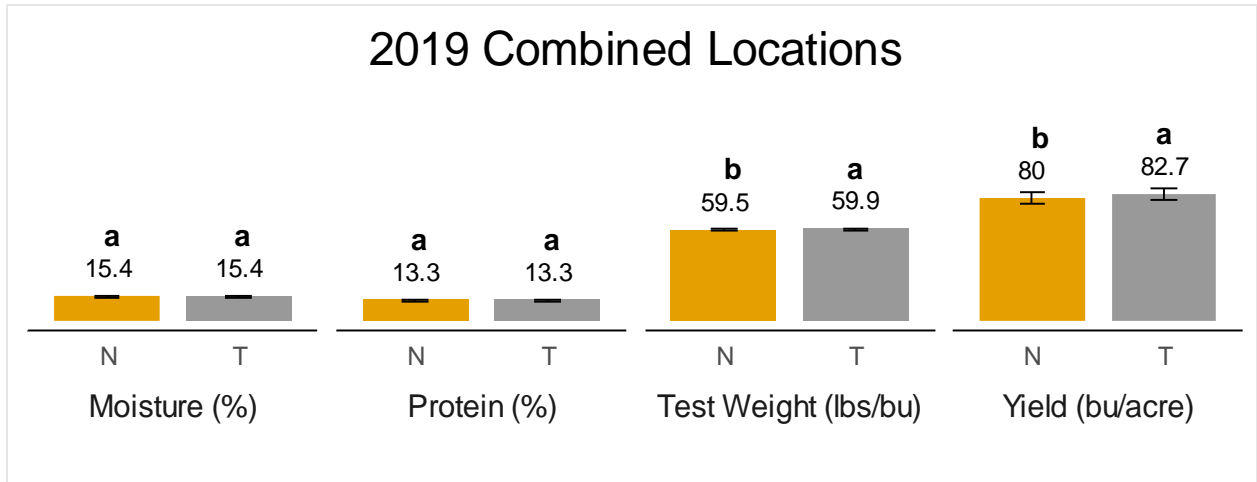


Figure 7. Moisture, protein, test weight, and yield results combined across six locations in 2019. Differing letters indicate differences among treatments at the 90% confidence level.

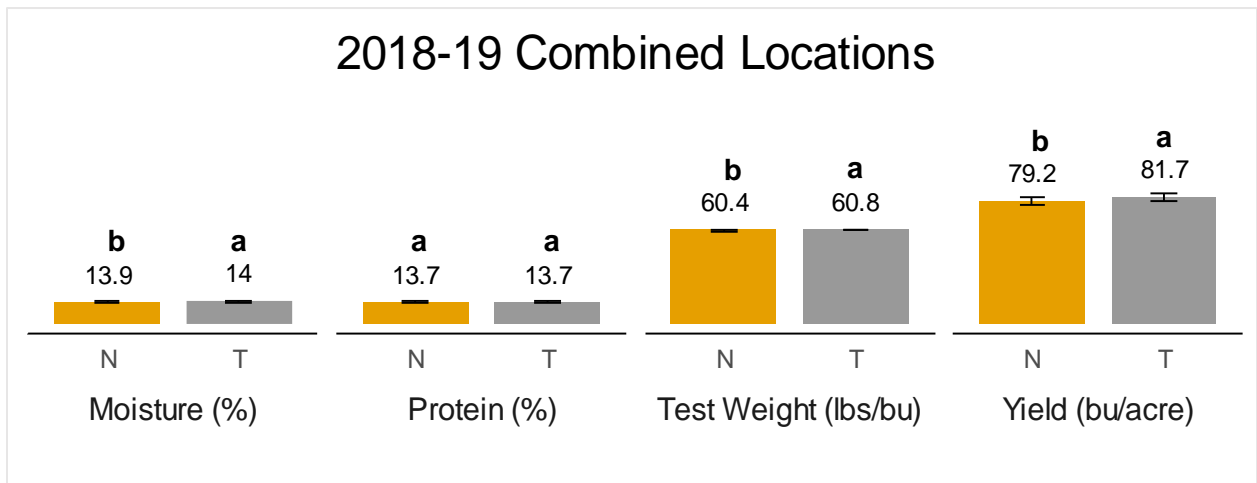


Figure 8. Moisture, protein, test weight, and yield combined across 11 locations from 2019-2019. Differing letters indicate differences among treatments at the 90% confidence level.

Table 3. Partial profit analysis of flag leaf fungicide application for individual varieties and combined locations from Figures 5 and 8.

Variety	SY Valda ¹	TCG Spitfire	WB 9590	WB Mayville	Combined
	(bu/acre)	(bu/acre)	(bu/acre)	(bu/acre)	(bu/acre)
Control	71.3	82.0	87.6	76.7	79.2
Treated	75.4	85.3	89.4	79.0	81.7
Yield difference	4.1	3.3	1.8	2.3	2.5
Application Cost ²	\$ 14.50	\$ 14.50	\$ 14.50	\$ 14.50	\$ 14.50
Net Revenue (per acre) ³	\$ 6.62	\$ 2.49	\$ (5.23)	\$ (2.66)	\$ (1.63)

1 SY Valda results based on one location from 2019

2 Application cost based on \$6.50/acre chemical + \$8/acre application costs

3 Revenue based on cash price of \$5.15/bu wheat

Conclusions

- Most fields did not exhibit strong disease pressure at the time of the flag leaf fungicide application, but did develop disease pressure later in the season
- On average, the flag leaf fungicide application increase yield by 2.5 bu per acre (Figure 8), but may not cover the cost of application (Table 3)
- One-two more years additional on-farm research may help determine the likelihood of a profitable yield response to a flag leaf fungicide application

Nitrogen Stabilizer

Overview

Determine if using a nitrification inhibitor (Centuro) with N applied as anhydrous ammonia will keep nitrogen available in the ammonium (NH₄⁺) form longer during the season to reduce N losses and increase yield or protein through greater available soil N.

Years of Study

2019

Treatments

Control – Producer rate NH₃ without stabilizer

Treatment – Producer rate NH₃ + 5 gal/ton N Centuro N-stabilizer

Methods

- Treatment were replicated four times at six locations in 2019.
- Plots were established and harvested with producer equipment. One plot is typically one to two passes of the application equipment wide by the full length of the field.
- Soil NO₃-N and NH₄-N was tested at two, four, and six weeks after planting
- At harvest, one combine pass from each plot is weighed in a weigh wagon or a grain cart at harvest and the grain is sampled to test moisture content, test weight, and protein content.
- All statistical analyses were conducted at the 90% confidence level
- Data not shown in this report are available at <https://mnwheat.org/farm-research-network/>

Table 4. Agronomic information for 2019 locations

	Roseau	Dorothy	Argyle	Erskine	St. Hilaire	TRF ¹
Variety	WB9590	Linkert	WB9590	LCS Trigger	LCS Rebel	SY Valda
Planting Date	5/9/2019	5/14/2019	4/26/2019	5/10/2019	5/6/2019	5/9/2019
Previous Crop	Soybean	Soybean	Sugarbeet	Soybean	Soybean	Soybean
Soil Type	Silt Loam	Sandy Loam	Silty Clay	Loam	Clay	Loam
SOM ²	4.1 %	4.2 %	--	4.3 %	4.6 %	3.3 %
Date Fertilized	10/24/2018	10/18/2018	4/25/2019	5/10/2019	5/6/2019	5/8/2019
Residual NO ₃	21 lbs	--	41 lbs	36 lbs	45 lbs	--
Total applied N	145	135	140	170	148	105

1 TRF - Thief River Falls, MN

2 SOM - Soil organic matter

Results

In-season Available-N

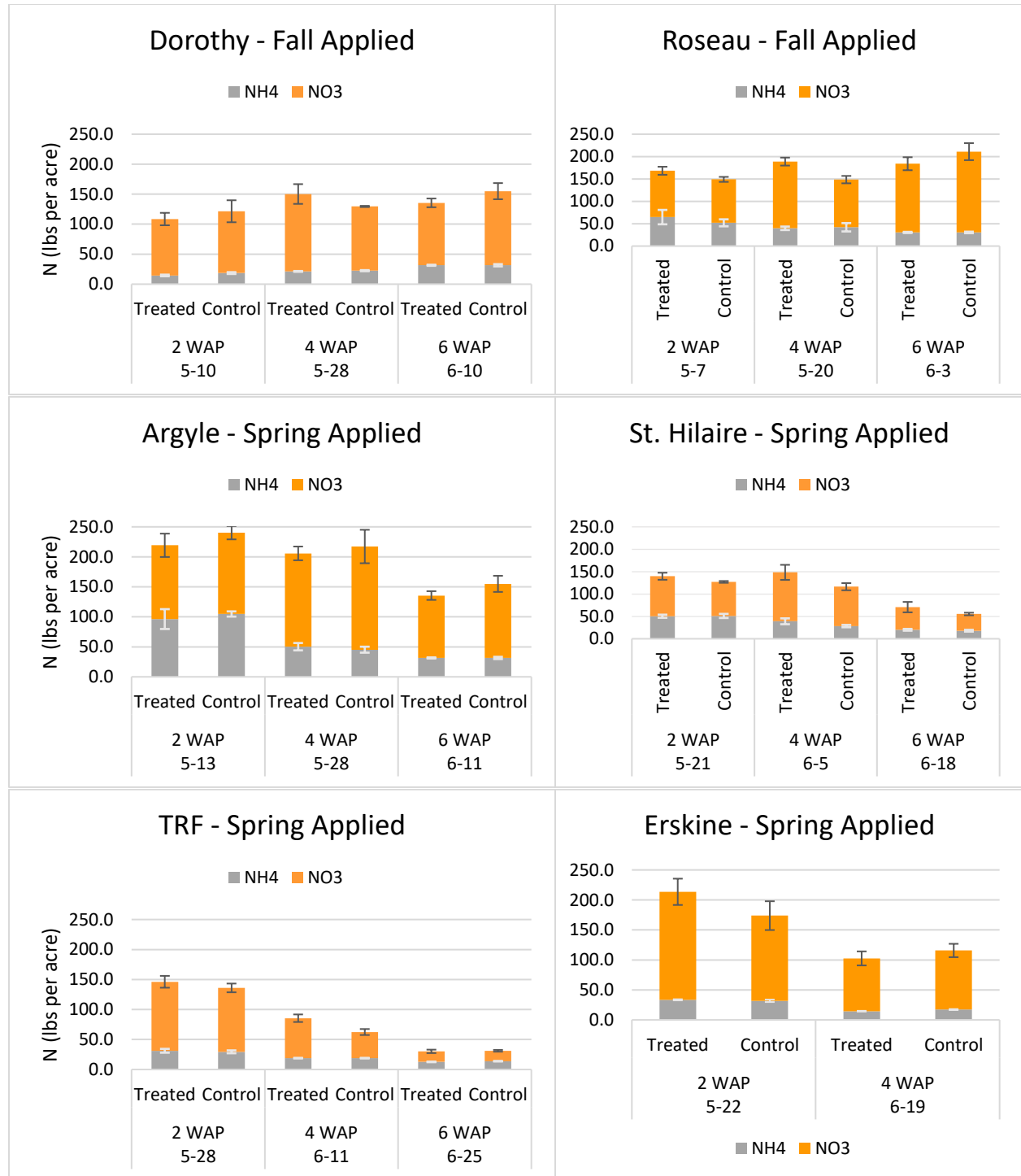


Figure 9. Proportion of soil NO₃-N and NH₄-N at 2, 4, and 6 weeks after planting at the 2019 locations. Differing letters indicate differences among treatments.

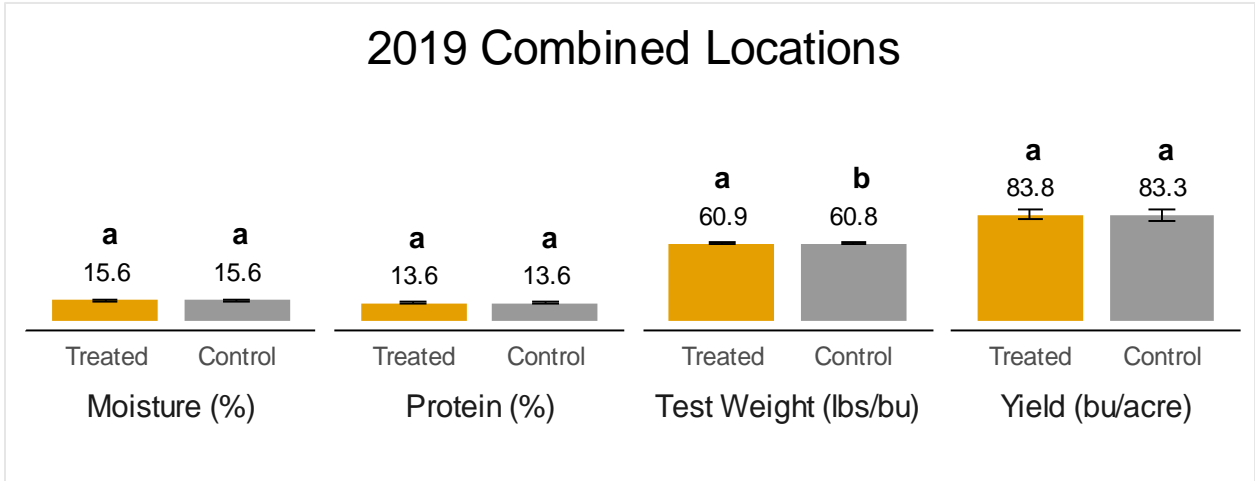


Figure 10. Moisture, protein, test weight, and yield from combined 2019 locations. Differing letters indicate differences among treatments at the 90% confidence level.

Observations

- There were no differences in ammonium-N or nitrate-N between treatments from in-season soil tests for any location (Figure 9).
- There were no differences in yield, protein, test weight, or moisture for the combined 2019 locations (Figure 10).
- Protein content was 0.3% lower in N-stabilizer treatment at Dorothy, and test weight was 0.4 lbs/bu greater with the N-stabilizer at Argyle (data not shown).
- In 2019, the lack of yield response did not cover the cost of the application.
 - Centuro - \$27 /gal at 5 gal/ton N = about \$0.07/ lb N or about \$9/acre at 130 lbs N/acre
- Several more years of research in various environments are needed before any conclusions can be drawn from this trial.

Sulfur Fertility

Objective To measure the effect of fertilizing with 100 lbs per acre AMS on wheat yield and protein.

Years of Study

2017-2019

Treatments

Control – No additional sulfur

Treatment – 100 lbs per acre ammonium sulfate (AMS, 21-0-0-24)

Methods

- Ammonium sulfate (AMS, 21-0-0-24) was applied preplant or top-dressed at 100 lbs per acre at 4 locations in MN in 2019. A total of 15 locations from 2017-2019 are included in the combined analysis.
- Three to four replications of each treatment were established and harvested with producer equipment at each location. One plot is typically one to two passes of the application equipment wide by the full length of the field.
- At harvest, one combine pass from each plot is weighed in a weigh wagon or a grain cart at harvest and the grain is sampled to test moisture content, test weight, and protein content.
- All statistical analyses were conducted at the 90% confidence level.
- Data not shown in this report are available at <https://mnwheat.org/farm-research-network/>

Table 5. Agronomic information for 2019 locations.

	Ada	Roseau-1	Roseau-2	Salol
Variety	WB 9590	Faller	WB 9479	Kelby
Previous Crop	Soybean	Soybean	Soybean	Soybean
Planting Date	5/10/2019	5/7/2019	5/12/2019	5/7/2019
Harvest Date	8/21/2019	8/30/2019	8/23/2019	8/22/2019
History of applied S?	Yes	No	Yes	No
Spring soil test S (0-24 in)	136 lbs	--	58 lbs	110 lbs
Soil Type	Sandy Loam	Silty Loam	Sandy Loam	Sandy Loam
Soil Organic Matter	2.30%	--	2.9	3.3%
Season total rain ¹	13.6 in	15.7 in	11.0 in	12.7 in

¹ Total precipitation between planting and harvest dates estimated using Corteva Field Planner

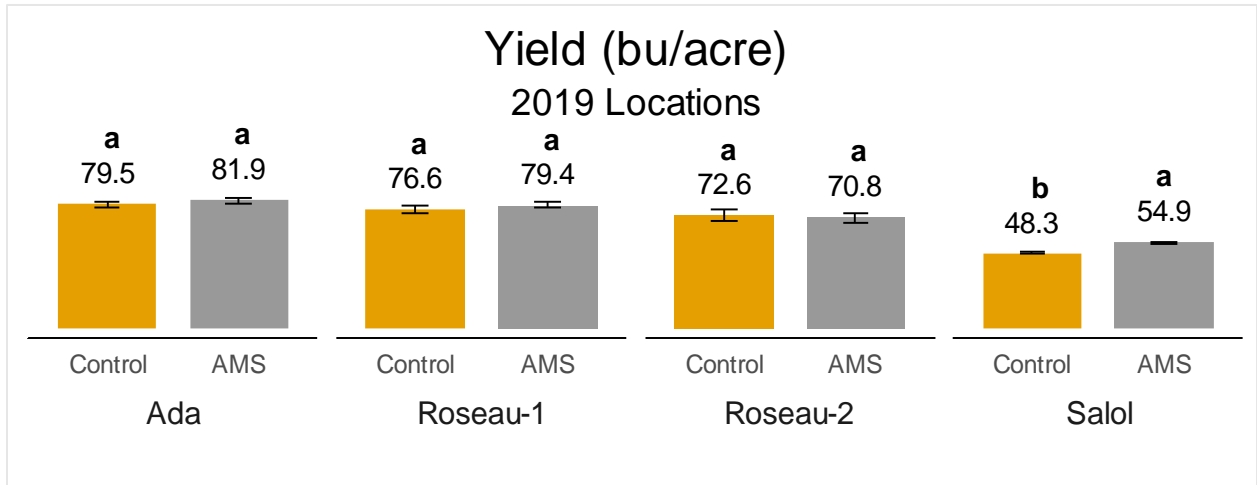


Figure 11. Yield response to AMS application at the four locations from 2019. Differing letters indicate differences among treatments at the 90% confidence level.

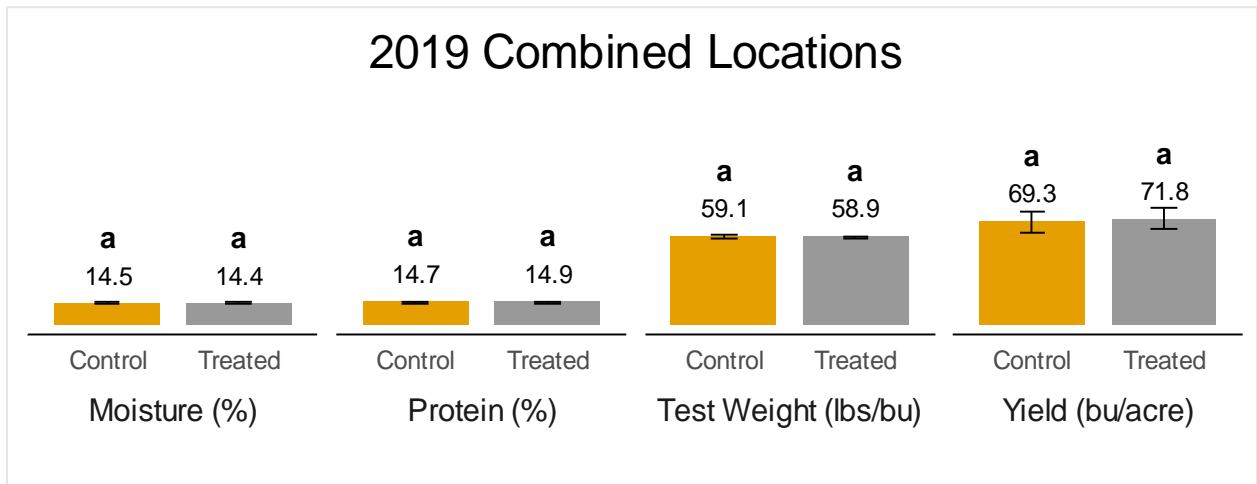


Figure 12. Moisture, protein, test weight, and yield results from the combined analysis of the four locations from 2019. Differing letters indicate differences among treatments at the 90% confidence level.

2017-19 Combined Locations

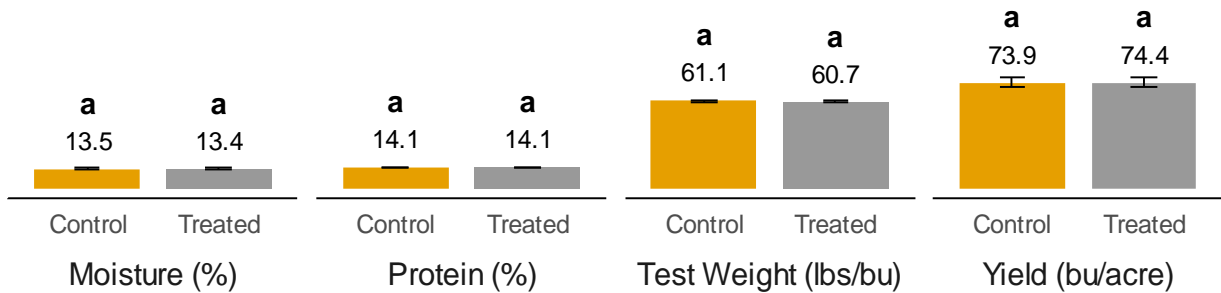


Figure 13. Moisture, protein, test weight, and yield results from the combined analysis of 15 locations from 2017-2019. Differing letters indicate differences among treatments at the 90% confidence level.

Results and Conclusions

- Roseau-1 and Salol did not have a prior history of sulfur fertilizer applications prior to 2019. The Salol location showed a 6.6 bu yield increase in response to added sulfur, but treatments at Roseau-1 were not different (Figure 11).
- When combined over all locations, there were no significant responses to sulfur applications (Figure 13).
- Pre-season sulfur soil testing many not predict the likelihood of crop response to sulfur application (Figure 11).

Long-term Elevated P and K Fertility

Objective

Compare the effects of elevated P and K fertility over four years of a wheat-soybean rotation

Years of Study

2019-2022

Treatments

Control – Producer rate of P and K fertility

Treatment – Producer rate P and K, + 50 units P + 50 units K

Methods

The on-farm large plots were conducted in conjunction with small-plot research locations in Roseau, MN, at the Magnusson research station. The small plot treatments include increasing fertilizer rates for P, increasing fertilizer rates for K, and increasing rates for the combination of P and K in both wheat and soybean plots. The results from the small plot treatments can be used to help interpret findings in the large-plot on-farm trials as we continue with this project.

- Treatments were replicated four times at two on-farm large plot study locations were established in the spring of 2019 at Elbow Lake and Baudette, MN. Poor weather conditions in 2018-2019 prevented treatment application at additional locations. We hope to add three more on-farm large plot locations beginning in 2020 for the remainder of the study.
- Fertilizer was applied by the producer’s co-op, and plots were harvested by the producer. Plots were one to two passes of the application equipment wide by the full length of the field.
- At harvest, one combine pass from each plot was weighed in a weigh wagon or a grain cart at harvest and the grain was sampled to test moisture content, test weight, and protein content.
- All statistical analyses were conducted at the 90% confidence level.

Table 6. Agronomic information for the 2019 locations

	Elbow Lake	Baudette
Crop	Soybean	Wheat
Variety	LG C1000RX	WB 9590
Date Fertilized	5-8-19 (treated strips)	5-14-19
Planting Date	5-12	5-15
Harvest Date	10-26	9-8
Soil Organic Matter	4.7%	2.9%
Soil Type	Clay Loam	Sandy Loam
Pre-season P	13 ppm	7 ppm
Pre-season K	171 ppm	109 ppm

Large-plot Results

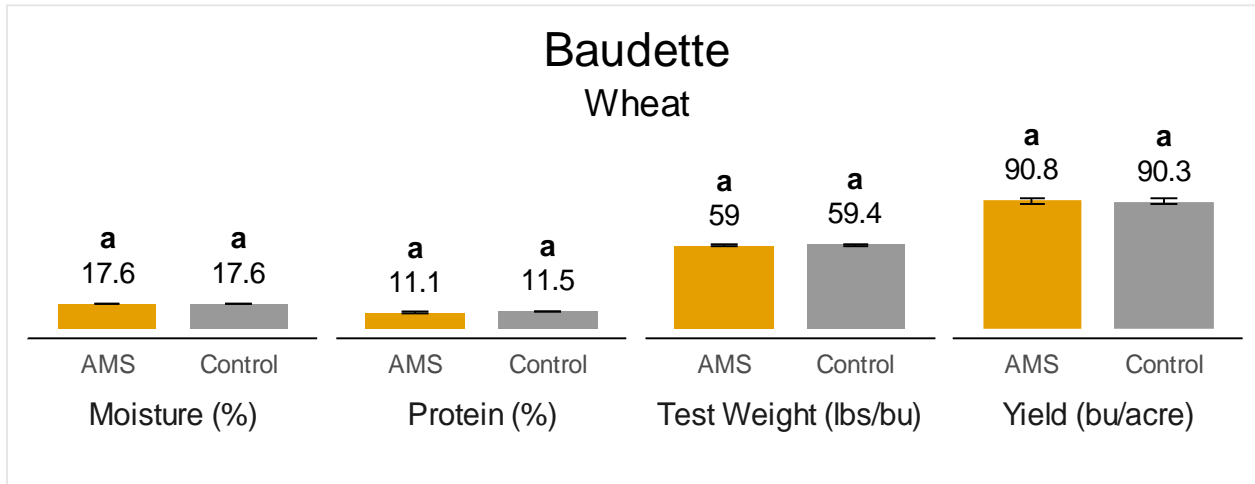


Figure 14. Results from Baudette in 2019. Differing letters indicate differences among treatments.

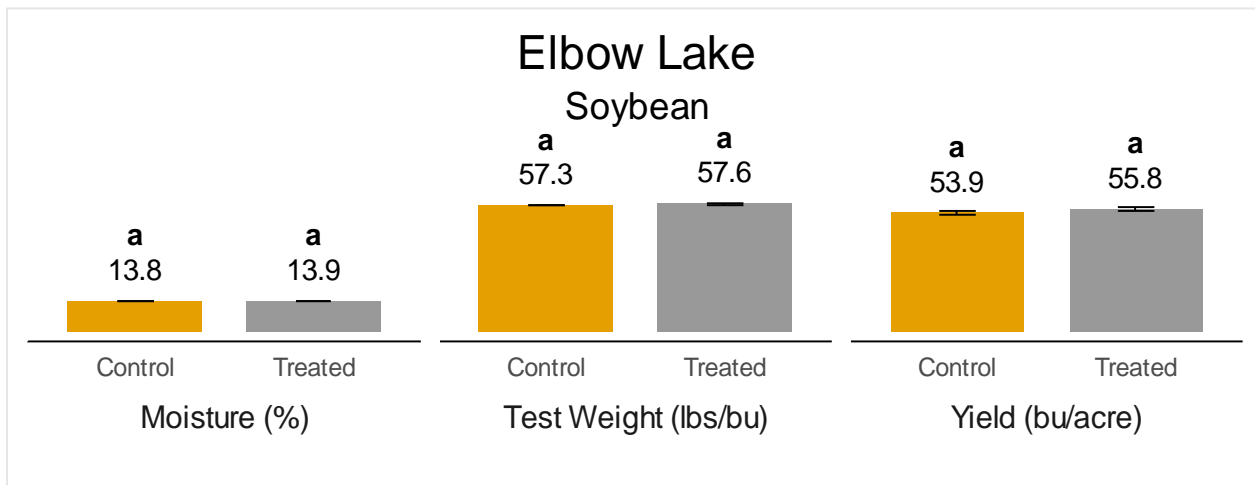


Figure 15. Results from Elbow Lake in 2019. Differing letters indicate differences among treatments.

Observations

- There were no observed differences between treatments at this location for the first year of this study
- Several more years of research in various environments at additional locations are needed before any conclusions can be drawn from this trial.

Small plot results

Table 7. Harvest data from wheat and soybean small plot research at Magnusson Research Station, Roseau, MN, 2019.

P + K Treatments ⁵	Wheat ^{1,2}			Soybean ^{3,4}			
	Test Weight	Protein	Yield	Test Weight	Protein ⁷	Oil ⁷	Yield ⁶
	lbs/bu	%	bu/acre	lbs/bu	%	%	bu/acre
0-20-0	60.3	15.3	85.0	57.4	36.7	20.4	65.3
0-40-0	60.3	15.3	86.3	57.5	37.1	20.4	62.0
0-60-0	60.2	15.1	87.3	57.2	37.4	20.5	61.5
0-80-0	60.3	15.1	85.3	57.5	36.9	19.6	61.0
0-100-0	60.2	15.2	92.8	57.1	37.8	20.3	63.8
0-0-20	60.0	15.4	81.3	57.3	37.0	20.4	61.8
0-0-40	60.0	15.4	81.5	57.5	37.0	20.4	63.5
0-0-60	60.0	15.5	83.3	57.5	36.9	20.2	67.5
0-0-80	60.3	15.7	81.3	57.5	37.0	20.0	61.5
0-0-100	60.1	15.7	82.5	57.4	37.0	20.3	68.0
0-20-20	60.1	15.3	89.0	57.3	36.9	20.3	67.8
0-40-40	60.1	15.2	86.5	57.5	36.7	20.0	64.3
0-60-60	60.2	15.1	85.3	57.4	37.0	20.5	64.3
0-80-80	60.0	15.3	77.5	57.5	37.2	20.3	62.3
0-100-100	60.3	15.2	87.8	57.3	37.4	20.2	68.5
0-0-0	60.2	15.3	82.3	57.3	36.9	19.9	61.7
LSD (95% conf. level)	0.3	0.2	8.6	0.4	NS	NS	NS
LSD (90% conf. level)	0.2	0.2	7.2	0.3	0.8	0.8	6.4
CV ⁸ (%)	0.3	1.1	7.2	0.5	1.8	2.3	8.5

1 Linkert wheat seeded @ 120#/acre 5/11/2019, 160-0-0 applied and incorporated in final seedbed prep.

2 Wheat harvest - 9/2/19

3 Asgrow AG005X8 soybeans seeded @ 225,000/acre 5/17/2019

4 Soybean Harvest 10-31-19

5 Treatments - 0-46-0 super phosphate and 0-0-60 potash used for P and K sources

6 Yield - Bushels per acre corrected to 12%moisture for wheat and 13%moisture for soybean

7 Protein and Oil-on dry matter basis

8 Coefficient of Variation – Measures overall trial variability, trials should generally vary by 10% or less

Wheat Small Plot Summary

- Tissue test results and soil sample data analysis are in progress and will not be presented at this time.
- Soil tests data indicated this site was low category for P and high for K.
- Trial average for wheat yield was 85 bu/acre, test weight was over 60#/bu and protein over 15%. Wheat yield in the untreated was 82.3 bu/acre.
- Generally, as the level of P increased wheat yields tended to increase to a top-end yield of 92.8 bu/acre from 0-100-0. However, wheat yield response to K was relatively flat.
- No treatment differences were detected in wheat test weight which ranged from 60-60.3 lbs/bu.
- Wheat protein ranged from 15.1 to 15.7. Wheat protein was relatively flat (15.1-15.3%) from the various levels of P and the combinations of P and K.
- Wheat protein was highest (15.5-15.7%) from K applied alone, especially with rates over 0-0-60.

Soybean Small Plot Summary

- Asgrow AG005X8 was seeded at 225,000 seeds/acre on 5/17/19.
- Phosphorus source in this trial was 0-46-0 as not to confound results with nitrogen that would have been contained in the 11-52-0.
- Soil tests data indicated this site was for very high for P and high for K. BMP's were followed for weed, insect and disease control. All plots were harvested on 10-31-19.
- Soybean yields ranged from 61- 68.5 bu/acre.
- Soybean test weight ranged from 57.1 to 57.5 lbs/bu.
- No statistical differences were detected between any of the treatments for soybean yield, protein or oil.
- Data pointed to a trend for higher soybean yield as the K rate increased.

Variable Rate Nitrogen

Objective

Compare a variable rate N application to a flat-rate N application.

Years of Study

2017-2019

Treatments

Flat – Flat rate of N, P, and K applied across field

VRN – N fertilizer variable rated based on 5 zones, 2 zones above the flat rate application and 2 zones below the flat rate application; P and K applied at a flat rate

VRNPK (some locations) – N, P, and K variable rated based on the 5 zones in the VRN treatment

Methods

- Treatments were applied preplant according to a variable rate prescription map created by a cooperating crop consultant, while P and K were applied at a flat rate across the field. Treatments were replicated 3-4 times depending on location.
- Fertilizer was spread by the producer or the producer’s co-op, and plots were harvested by the producer. Plots were one to two passes of the application equipment wide by the full length of the field.
- At harvest, one combine pass from each plot was weighed in a weigh wagon or a grain cart at harvest and the grain was sampled to test moisture content, test weight, and protein content.
- Residual NO₃-N was sampled in 3 zones following harvest. The two lower zones were combined into a ‘Low Productivity’ zone, the middle flat-rate zone was sampled as the ‘Medium Productivity’ zone, and the higher two zones were combined into a ‘High Productivity’ zone.
- All statistical analyses were conducted at the 90% confidence level.

Table 8. Agronomic information for 2019 locations.

	Comstock	Crookston-1	Crookston-2	Gentilly	Plummer	Terrebonne
Variety	Bolles	WB 9479	CP 3530	WB 9479	Shelly	WB 9590
Previous Crop	Soybean	Soybean	Soybeans	Soybeans	Soybeans	Soybeans
Planting Date	5/10/2019	5/14/2019	5/17/2019	11/5/2018	6/7/2019	5/14/2019
Harvest Date	5/11/2019	5/13/2019	5/17/2019	5/7/2019	5/5/2019	5/14/2019
Pre-App Residual NO ₃ (0-24 in)	--	28 lbs	29 lbs	--	--	14 lbs
Soil Type	Silty Loam	Silty Clay Loam	Loamy Sand	Loam	Sandy Loam	Sandy Loam
Soil Organic Matter	4.5%	--	2.9%	--	2.0%	2.6%
Season total rain ¹	15.6 in	12.3 in	17.2 in	15.1 in	15.2 in	14.5 in

¹ Total precipitation between planting and harvest dates estimated using Corteva Field Planner

Results

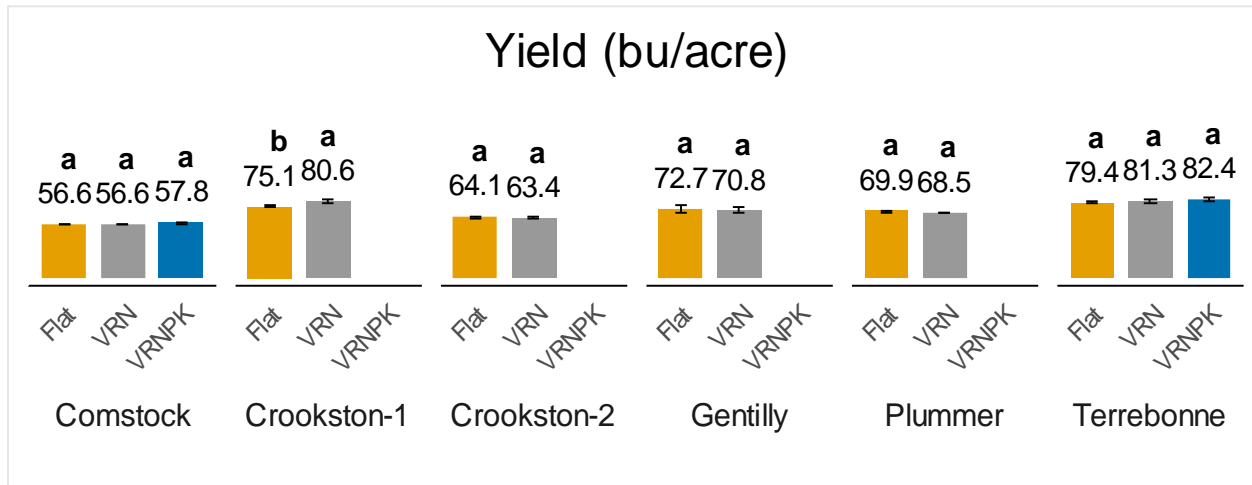


Figure 16. Yield between VRN and Flat-rate treatments at six locations in NW MN in 2019. Differing lowercase letters indicate significant differences between treatments at the 90% confidence level.

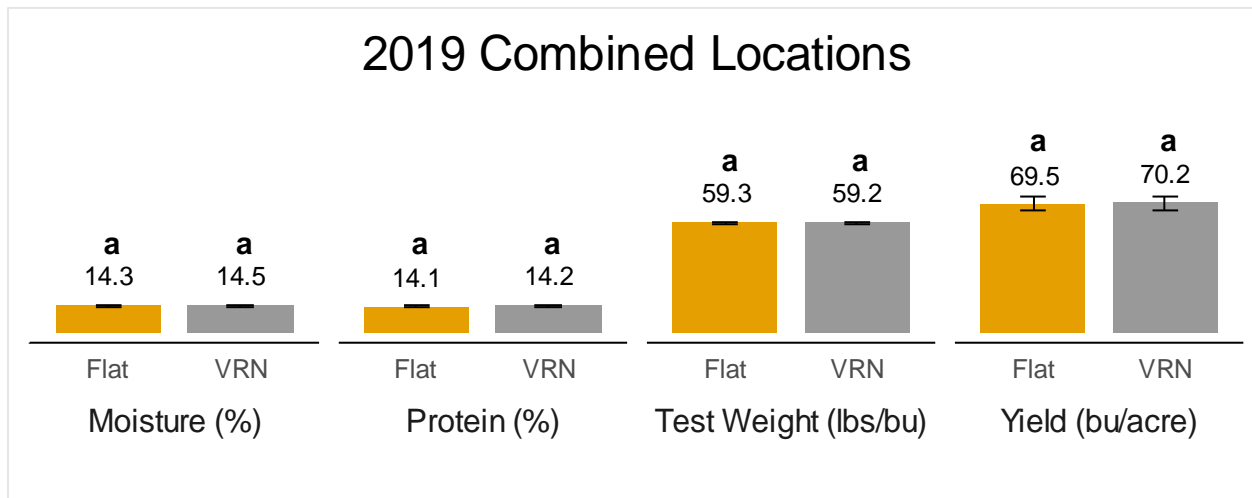


Figure 17. Moisture, protein, test weight (TW), and yield between VRN and Flat-rate treatments combined across six locations in 2019. Differing lowercase letters indicate significant differences between treatments at the 90% confidence level.

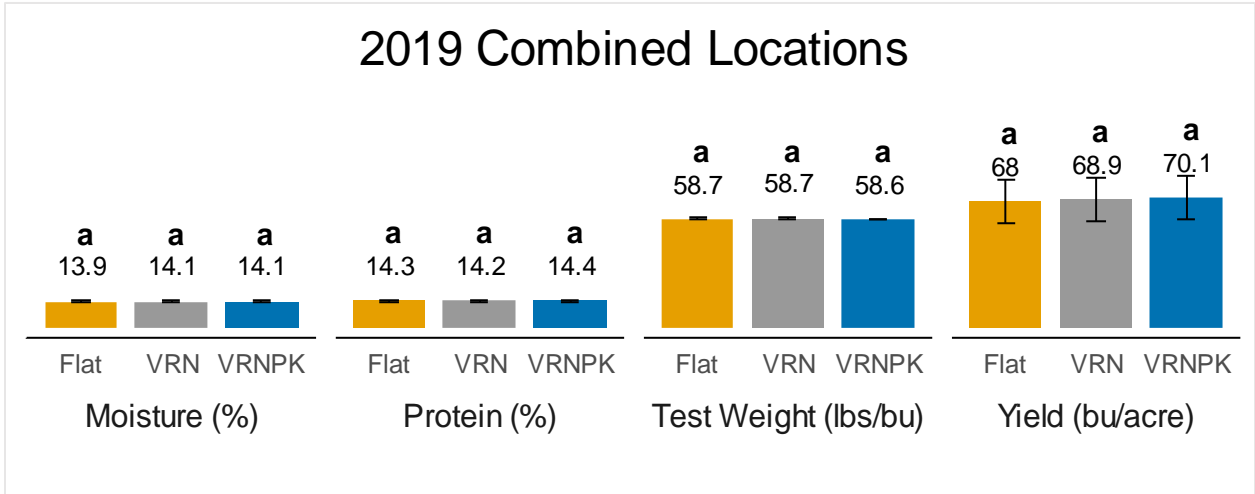


Figure 18. Moisture, protein, test weight (TW), and yield among treatments combined across two locations in 2019 that included a VRNPK treatment in addition to the Flat-rate and VRN treatments. Differing lowercase letters indicate significant differences between treatments at the 90% confidence level.

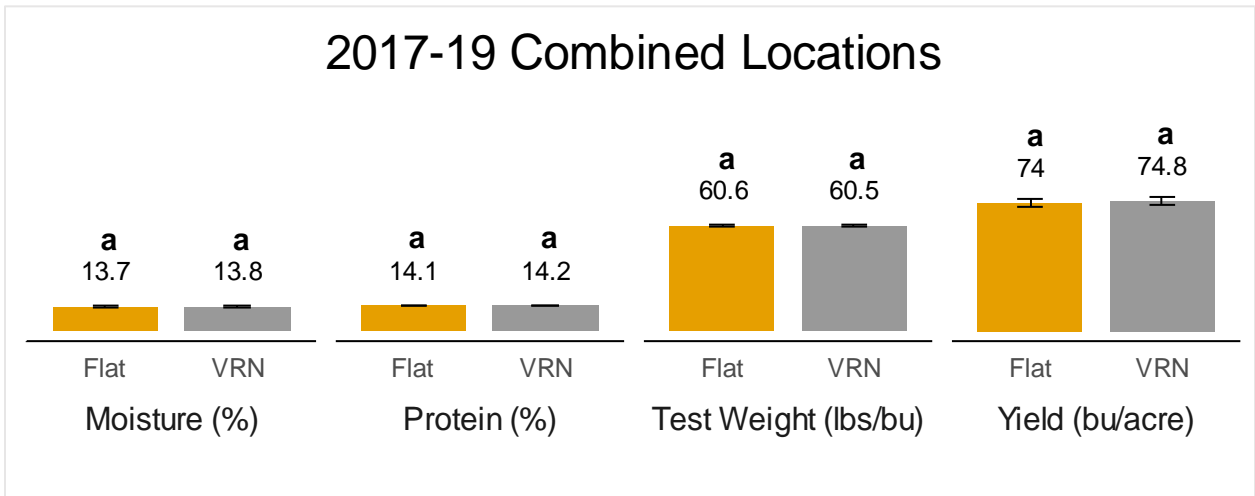


Figure 19. Moisture, protein, test weight (TW), and yield between VRN and Flat-rate treatments combined across 15 locations in NW MN from 2017-2019. Differing lowercase letters indicate significant differences between treatments at the 90% confidence level.

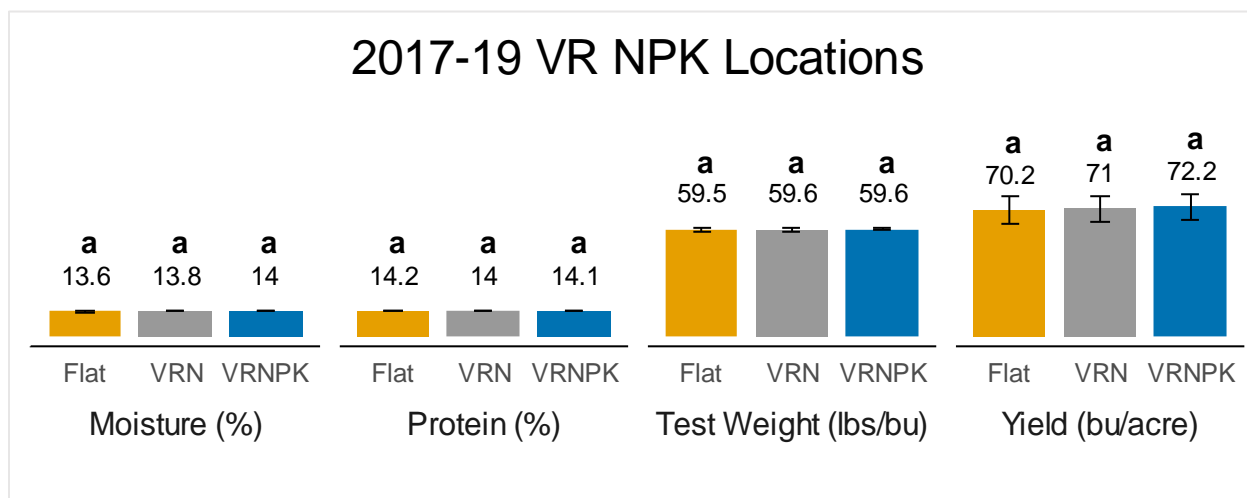


Figure 20. Moisture, protein, test weight (TW), and yield among treatments combined across two locations in 2019 that included a VRNPK treatment in addition to the Flat-rate and VRN treatments. Differing lowercase letters indicate significant differences between treatments at the 90% confidence level.

Conclusions

Yield Data

- Crookston-1 showed a 5.5 bu yield increase in the VRN treatment compared to the Flat rate treatment (Figure 16). All other locations did not show any significant differences between treatments in 2019.
- When averaged across management zones, there were no differences among treatments for combined locations in 2019 and combined across all years from 2017-2019 (Figures 17-20).

Residual Soil Nitrate (Figure 21, page 26)

- Gentilly showed an average of 6.8 lbs residual NO₃-N more in the VRN plots compared to the Flat rate plots when averaged over management zones (data not shown).
- Crookston-1 showed an average of 12.1 lbs residual NO₃-N more in the VRN plots compared to the Flat rate plots when averaged over management zones (data not shown). This is because there was significantly more residual NO₃-N in the VRN-High productivity compared to all other rate-zone treatments (Figure 21).

Variable Rate Nitrogen

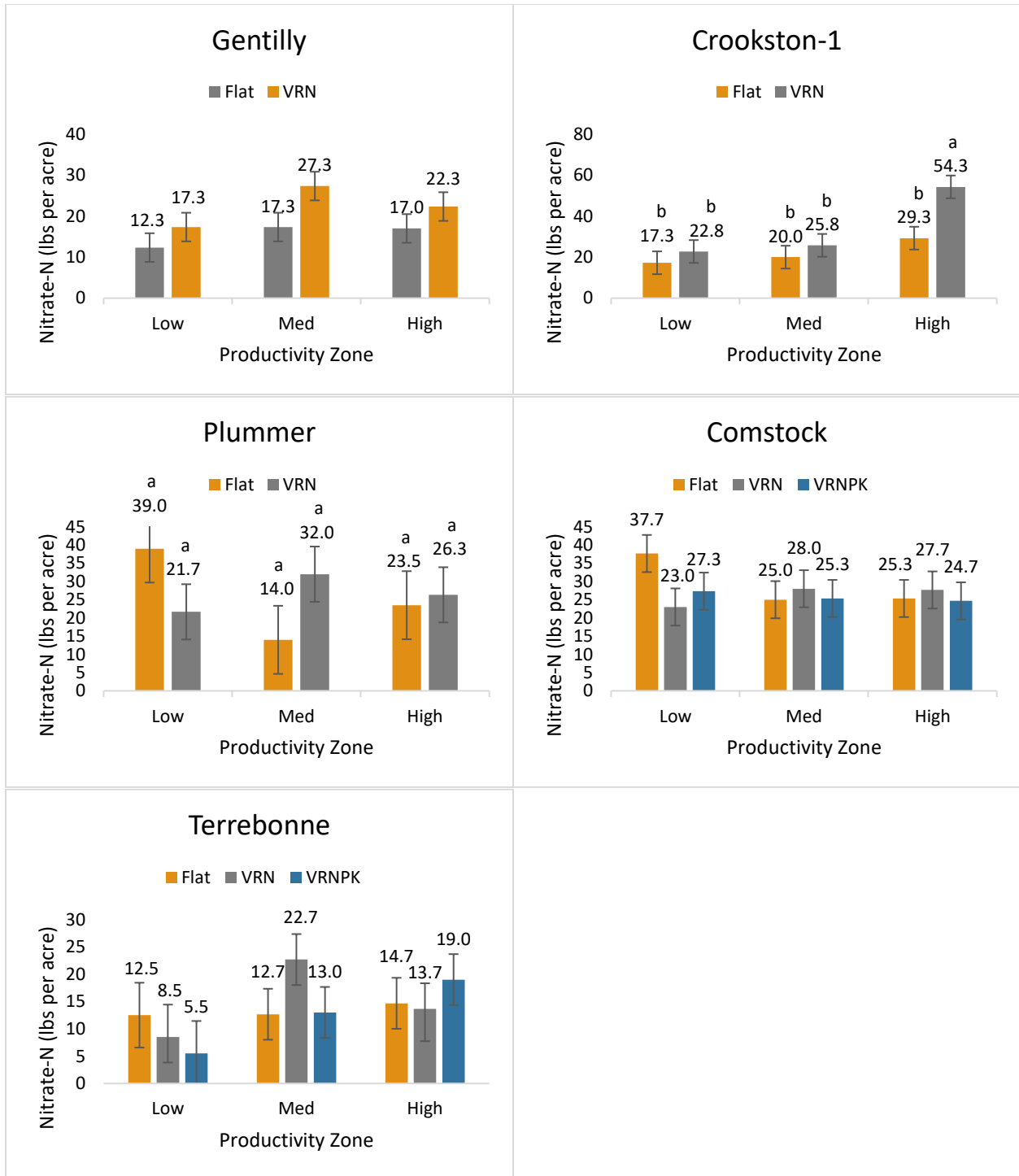


Figure 21. Residual 0-24 in soil NO₃-N (lbs per acre) in the lowest-N rates, middle-N rate, and highest-N rate zones after harvest at five locations in 2019. Differing letters indicate differences among treatments across zones at the 90% confidence level.

Vertical Tillage

Objective

Determine the effect of vertical tillage on spring soil temperature and moisture and crop yield compared to conventional tillage with a chisel plow and field cultivator in a wheat-soybean rotation.

Years of Study

2017-2019

Treatments

Equipment

- Salford 570 RTS Vertical Tillage
- Chisel plow with twisted shanks
- Field cultivator
- Air seeder with 11 in sweeps at 7.5 in spacing

Following wheat

- Conventional till (CT) – Two fall passes chisel plow + 1 pass field cultivator; one spring cultivator pass as needed
- Vertical till (VT) – Two fall passes vertical tillage; one spring vertical tillage pass as needed

Following Soybean

- Conventional till (CT) – One fall pass chisel plow + 1 fall pass with field cultivator; one spring cultivator pass as needed
- Vertical till (VT) – One fall pass vertical tillage; one spring vertical tillage pass as needed

Methods

- Tillage treatments were implemented as described above.
- Soil temperature and moisture at a depth of 2 in were measured one week before planting, at planting, and one week after planting.
- Treatments were replicated three times at one location near Gently, MN.
- Fertilizer was spread by the producer's co-op and plots were harvested by the producer. Plots were one to two passes of the application equipment wide by the full length of the field.
- At harvest, one combine pass from each plot was weighed in a weigh wagon and grain was sampled to measure test weight and moisture, and protein, and oil content.
- All statistical analyses were conducted at the 90% confidence level.

Results

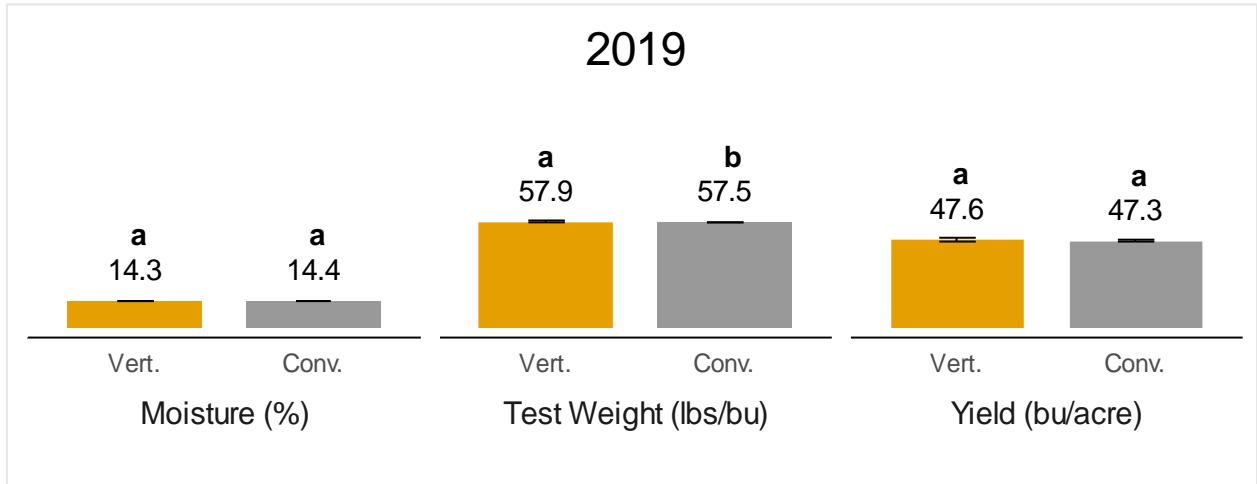


Figure 22. Harvest data from 2019 soybean crop. Differing letters indicate differences among treatments at the 90% confidence level.

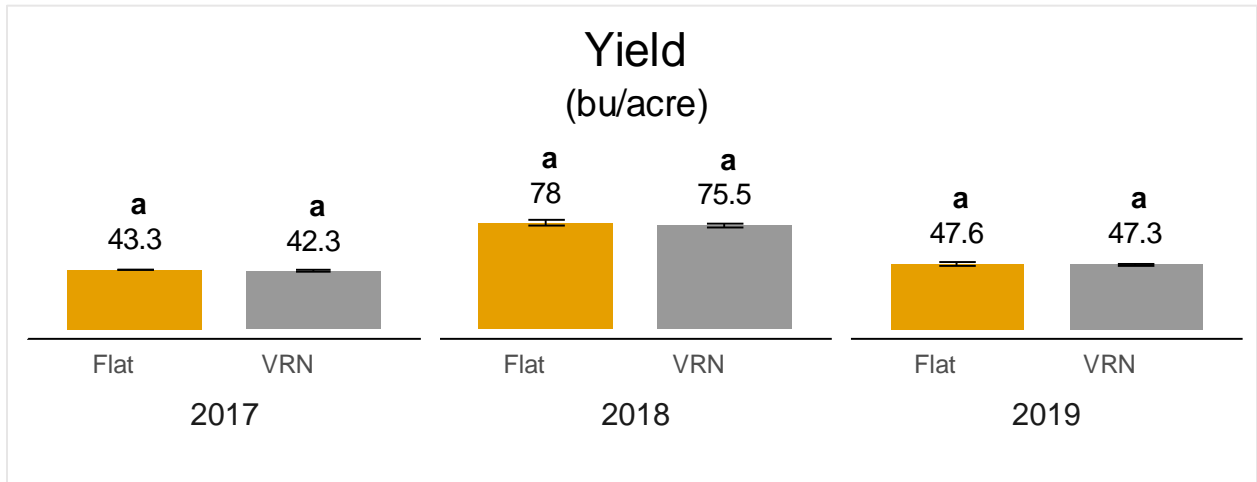


Figure 23. Yield results from 2017-2019. Differing letters indicate differences among treatments at the 90% confidence level.

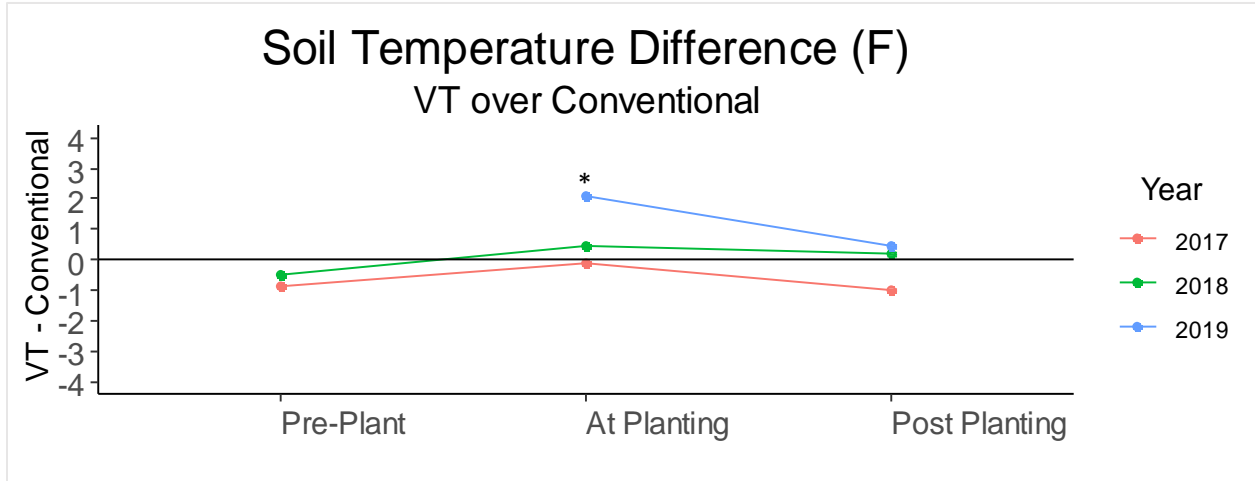


Figure 24. Soil temperature difference (F) between Conventional till and Vertical till treatments. Data points above and below the black line represent the average temperature of the Vertical till treatment compared to the Conventional till treatment. Differences between treatments within each measurement date are signified with a (*) at the 90% confidence level.

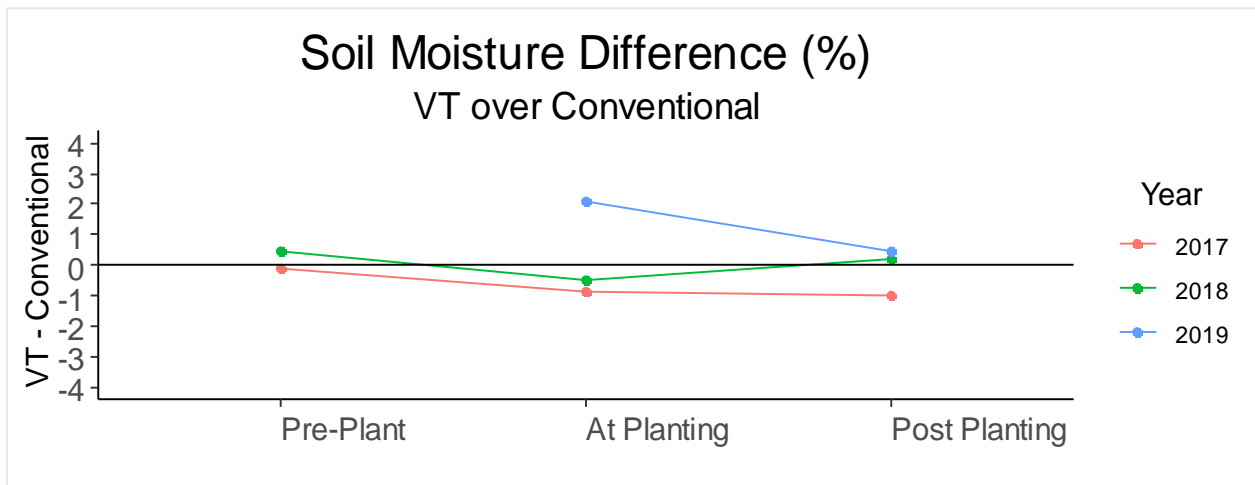


Figure 25. Difference in soil moisture (% v/v) between Conventional till and Vertical till treatments. Data points above and below the black line represent the average temperature of the Vertical till treatment compared to the Conventional till treatment. There were no differences between treatments.

Conclusions

- Reducing tillage from the Conventional tillage practices to the Vertical tillage practices did not reduce yield or grain quality
- Overall, there were no major differences in spring soil moisture and temperature between treatments. Soil temperature was significantly greater in the Vertical Till treatment At Planting by 2.1°F in 2019. All other dates were not different between treatments.
- Anecdotal observations from the producer included less soil blowing on windy days and greater snow catch during the winter in the Vertical till plots. The producer also noted smoother travel over the Vertical till plots, although there was more resistance from the soil when planting into the Vertical till plots compared to the Conventional till plots.

ON-FARM RESEARCH NETWORK LEADERSHIP TEAM

WHO WE ARE

Minnesota Wheat's On-Farm Research Network (OFRN) conducts producer-funded, producer-driven research that investigates producer-selected research topics in a large plot environment.

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