Variable Rate Nitrogen

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

N was 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. Trials included 3-4 replications of VRN and Flat-Rate strips applied with a fertilizer spreader along the full length of the field at seven locations in 2018. Harvested strips were weighed in a weigh wagon and sampled to measure moisture, test weight, and protein content.

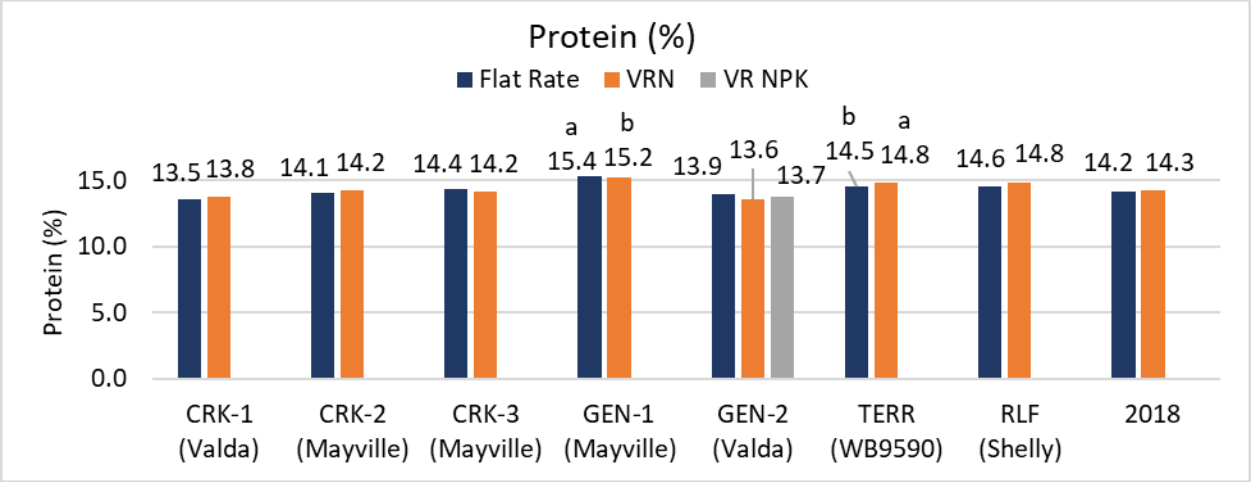

Figure 1. Protein content between VRN and Flat-Rate treatments at 7 locations in NW MN in 2018. Differing lowercase letters indicate significant differences between treatments at the 90% confidence level.

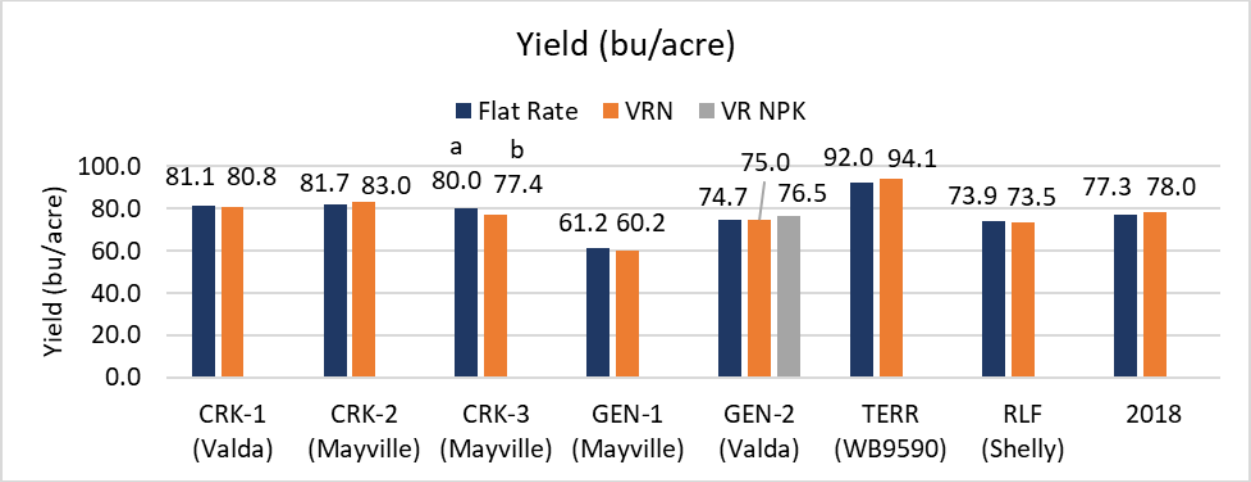

Figure 2. Yield between VRN and Flat-Rate treatments at 7 locations in NW MN in 2018. Differing lowercase letters indicate significant differences between treatments at the 90% confidence level. One location near Gentilly also included a treatment with variable N, P, and K rates.

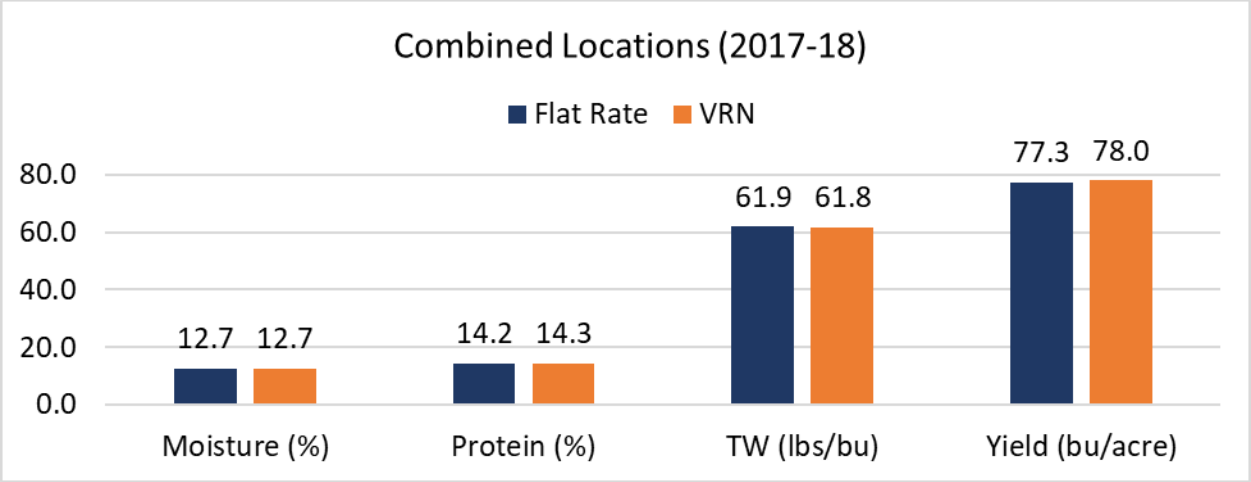

Figure 3. Moisture, protein, test weight (TW), and yield between VRN and Flat-Rate treatments combined across 9 locations in NW MN in 2017 and 2018. Treatments were not significantly different from each other at the 90% confidence level.

Table 1. Economic analysis of the VRN application profitability.

	Flat Rate	VRN	Yield gain	$ Yield gain	VRN cost	Profit
	----------	bu/acre	---------	---------	$/acre	--------
Crookston-1	81.1	80.8	-0.3	$ (1.50)	$ 7.50	$ (9.00)
Crookston-2	81.7	83.0	1.2	$ 7.02	$ 7.50	$ (0.48)
Crookston-3	80.0	77.4	-2.6	$ (14.79)	$ 7.50	$ (22.29)
Gentilly-1	61.2	60.2	-0.9	$ (5.36)	$ 7.50	$ (12.86)
Gentilly-2	74.7	75.0	0.2	$ 1.33	$ 7.50	$ (6.17)
Terrebonne	92.0	94.1	2.1	$ 11.66	$ 7.50	$ 4.16
Red Lake Falls	73.9	73.5	-0.4	$ (2.09)	$ 7.50	$ (9.59)
2018	77.3	78.0	0.7	$ 4.10	$ 7.50	$ (3.40)
2017-18	78.0	78.0	0.0	$ 0.09	$ 7.50	$ (7.41)

1 Calculated at $5.69/bu of wheat

2 Estimated based off $1.75/acre to create application map, $4.75/acre zone soil sampling, and $1.00 variable rate application cost.

Conclusions:

- There were no differences in moisture, protein, test weight, between the VRN and Flat-Rate treatments in 2018 and when combined with the 2017 results (data not shown). At CRK-3, yield decreased with a VRN application by 2.6 bushels (Figure 2). Thus far, we cannot conclude that a VRN application will increase yield or protein to improve the overall profitability of a field.
- These data are the averages of the field length strips across all fertility zones, and do not account for crop response to fertility within each zone. Further GIS spatial analysis during the winter of 2018-19 will analyze crop response to increased or decreased N rate within each of the field zones.