Characterizations of Climate Corp variable rate nitrogen tool

Background:

The ability to vary nitrogen applications according to yield levels, soils or terrain has tremendous potential for Iowa's corn farmers. In theory, profitability and nitrogen use efficiency will be increased as nitrogen is applied according the greatest crop need as compared to single rate applied across the entire field. Improved nitrogen use efficiency means greater profit potential for farmers and potential reductions of nitrogen loss into nearby water sources.

The biggest problems with variable rate nitrogen (VRN) application are that farmers may not know how to create nitrogen response zones on their farms or know what rates to place in which nitrogen response zone. To solve these problems, Climate Corporation developed a decision aid to assist farmers in creating management zones along with nitrogen rate recommendations for the individual zones. In this research, the Iowa Soybean Association On-Farm Network® tested the Climate Corp approach to VRN nitrogen in eight fields in 2018.

Protocol:

VRN applications were written according to Climate Corp nitrogen models for the various zones. In each field the climate VRN prescription was compared to the farmer's standard rate of nitrogen in replicated strips. All VRN was applied as side-dressed UAN solution.

Climate Corp offers various methods for creating management zones from SURGO soils to satellite imagery as well as yield history. In this research, the On-Farm Network used the combination of SURGO soils and historical satellite imagery to create management zones.

Yield monitor data from the trials was cleaned according to industry standards. Yield analysis was performed using mixed model methodology to determine statistical significance. All comparisons were subjected to economic analysis. Economic assumptions in this report are based upon an anticipated prescription price of $3.00/acre, $3.75/bushel corn price, and a nitrogen price of $0.40/lb.

Outcome:

On average, the profit for VRN using the Climate Corp model was $0.90/acre with an average yield advantage of 2 bu/acre. However, the range of responses varied from −$46.00/acre to $26.00/acre. Locations with the greatest response tended to be very non-uniform fields. Fields with the negative advantage tended to be more uniform fields where the cost savings from more efficient nitrogen placement was not enough to overcome the costs of the prescription.

Yield advantages for the Climate Corp VRN prescriptions were generally positive with one outlier. This field, ST2018IA196, realized a −12.6 bu/acre advantage. In this field, the Climate Corp rate recommendations were significantly lower than the farmer's standard practice. Data from this field could be used to refine and improve upon the model, ensuring future success for the product.

In conclusion, the Climate Corp VRN model performed profitably on non-uniform fields. Future work could focus on the use of yield history to create management zones, even though the combination of SURGO soils and satellite imagery performed well in 2018.

Table 1: Comparison of Climate Corp VRN to single-rate nitrogen application.

Location	Climate VRN	No-VRN	Difference	Pr>t[1]	Profit ($/A)
	----------Yield (bu/A)----------				
ST2018IA0097A	195.5	192.8	2.7	0.92	−1.9
ST2018IA0097B	200.0	195.3	4.7	0.36	5.6
ST2018IA0098	200.2	195.9	4.3	0.57	18.8
ST2018IA0149	170.1	169.0	1.1	0.4	1.7
ST2018IA0150	149.5	141.0	8.5	0.006	9.0
ST2018IA0195	153.6	149.6	4.0	0.03	26.0
ST2018IA0196	224.7	237.3	−12.6	0.12	−46.0
ST2018IA0227	196.4	193.9	2.5	0.92	-5.8
Average	186.1	184.4	1.9		0.9

[1]Pr>t is an estimate of the statistical difference in the trial. Values above 0.15 indicate the yield difference is due to chance alone.