

HOW ACCURATE IS THE GREENSEEKER AT APPLYING VARIABLE RATE NITROGEN WITH LARGE NITROGEN VARIABILITY IN A FIELD?

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The Greenseeker is a real-time, on-the-go sensor/applicator that senses the greenness and growth of the wheat crop at the time nitrogen is applied and then simultaneously adds the precise amount of nitrogen that is determined to be needed by the machine.

Several years of basic field research using the Greenseeker has resulted in two reliable algorithms for Kentucky for soft red winter wheat. Both were developed using intensive management for high-yield wheat, one for soft red winter wheat on moderately well- to well-drained soils and another for moderately to somewhat poorly drained soils. The first one has been field tested with excellent results, and the other has not yet been fully field tested.

Field trials were used to verify the validity of the algorithm for wheat growing on moderately well- to well-drained soils under farm conditions using the farmer's scale of equipment over a three-year period.

Variable rate nitrogen on wheat using the Kentucky algorithm always resulted in higher yields and higher returns when compared to a flat N rate as recommended by experienced professional wheat consultants.

The variability is usually not extremely large. If the variability within the field is very large would the Greenseeker, using the Kentucky algorithm, also be accurate under these conditions.

OBJECTIVE

Determine the accuracy of the Greenseeker, using the Kentucky algorithm, for applying variable rate on a field of soft red winter with a very wide

difference in the field due to residual nitrogen carryover or an earlier application.

METHOD

The trial was established on a Pembroke silt loam Soil that is well suited for high yield wheat production and the algorithm for moderately well to well-drained soil types was used. Small plots were used to test the theory.

Six replications were used. Nitrogen was applied at 6 different rates at Feekes 3 on February 19. The application rates were: 0, 30, 60, 90, 120 and 150 lbs/ac and ammonium nitrate was used as the nitrogen source.

At Feekes 6, April 4, each of the 36 plots was read with the Greenseeker resulting in a NDVI reading for each plot. A nitrogen rate was calculated for each of the plots using the Kentucky algorithm using each individual NDVI. The calculated nitrogen rate for each plot was applied to that plot on April 5. The average of all 6 150 lb/ac N rate plots were used as the N-rich strip NDVI and no Feekes 6 nitrogen was applied to these plots.

RESULTS

The Greenseeker readings at Feekes 6 clearly showed the different nitrogen treatments that were added at Feekes 3 as shown in the NDVI reading found in Table 1. There were differences between the NDVI readings in the 6 different plots in the same treatment. This resulted in different calculated and applied nitrogen rates in the same treatment (Table 1).

Using the Kentucky moderately well to well-drained algorithm, the calculated nitrogen rates applied at Feekes 6 seem to decrease slower than the increase in the nitrogen rates applied at

Feekes 3. Therefore, nitrogen rates above 60 lbs per acre that was applied at Feekes 3 resulted in total N rates higher than was probably needed and increased lodging. There was no statistical differences in yield, but the highest yields occurred when either 30 or 60 lb/ac of nitrogen was added at Feekes 3 (Table 2).

All yields were very high. Excellent yields were also recorded when no nitrogen was added at Feekes 3 and all the nitrogen was added at Feekes 6 using the Greenseeker and the Kentucky algorithm.

SUMMARY

The Greenseeker was able to detect large difference in the amount of nitrogen than was in the soil or in the plant at Feekes 6.

Using the Kentucky algorithm the best results (high yields and less lodging) were found when the Feekes 3 additions were between 0 and 60 lb/ac of nitrogen.

Using the Kentucky algorithm, high yields were obtained with nitrogen rates between 0 and 120 lb/ac of nitrogen added at Feekes 3, but the highest yields were found when 30 or 60 lb/ac were added.

Table 1. Range of Individual Plots and Average for each Nitrogen Treatment of the NDVI Greenseeker Reading and Feekes 6 Calculated and Applied Nitrogen Rates and Total Feekes 3 Plus Feekes 6 Nitrogen Applied					
Feekes 3 Nitrogen Rate	Feekes 6 NDVI Readings		Calculated Nitrogen Rate (lb/ac)		Total Nitrogen Applied (lb/ac)
	Lb/ac	Range	Avg.	Range	Avg.
0	0.61-0.69	0.65	104-122	114	114
30	0.6-0.72	0.69	97-108	103	133
60	0.75-0.79	0.77	70-87	80	140
90	0.78-0.81	0.79	40-75	68	158
120	0.76-0.82	0.80	20-83	51	171
150	0.81-0.84	0.83	0	0	150

Table 2. Range of Individual Plots and Average for each Nitrogen Treatment of Grain Yield and Lodging Estimates.				
Feekes 3 Nitrogen Rate	Harvest Yields (bu/ac)		Lodging at Harvest (%)	
	Lb/ac	Range	Avg.	Range
0	115-120	117 ab	0	0 a
30	114-129	121 a	0-10	3 ab
60	117-123	121 ab	0-30	16 bc
90	110-125	117 ab	0-55	30 cd
120	114-123	119 ab	0-60	44 d
150	105-121	114 b	15-65	36 d