# IMPROVING NITROGEN APPLICATION TECHNOLOGY UNDER KENTUCKY CONDITIONS 2009

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## OBJECTIVE

The objective of this experiment is to: 1) Adapt variable rate nitrogen (VRN) technology (Greenseeker) to Kentucky conditions and 2) Fine tune nitrogen recommendations under today's production practices and varieties for the most economical nitrogen rate on well drained and marginally drained soils.

### *Variable Rate Nitrogen Technology*

The Greenseeker is a real-time, on-the-go sensor/applicator that senses the health 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. The sensing and application technology part of the machine has been very accurate and reliable. The weak part of the process has been the algorithm (formula) that is placed in the software of the machine to tell it how much nitrogen to add based on the plant health (NDVI) readings.

Research at Oklahoma State University and Virginia Polytechnic Institute and State University showed favorable results by increasing or maintaining wheat yields while reducing nitrogen application rates. Both places had different algorithms. Using these two algorithms and adding another that was quite dissimilar, the results in Kentucky were not as favorable. Using this technology with existing software is not feasible in Kentucky.

## METHODS

Basic research was begun to gain the information needed to develop an algorithm for Kentucky. Small plots using different nitrogen rates applied at different times on different soils was used in the process.

## RESULTS

The results are for three years so they are still somewhat preliminary. The first year there was an Easter freeze which caused severe damage to the plants and the results of that year may be atypical of that found most years. The second year was more normal and the curves look much better. This third year, the results (N recommendations from the NDVI Readings) look acceptable for the Feekes 6, but questionable for the Feekes 5 readings.

### *Variable Rate Nitrogen*

The information gathered from the NDVI (normalized difference vegetative index) readings, and the nitrogen needed for optimum yields are shown in table 1. The relationships with yield (figure 1) show a nice nitrogen response.

The different nitrogen rates explained 48% and 77% of the differences in plant health (NDVI) of the wheat grown on Zanesville and Pembroke soil, respectively, at Feekes 5. It explained 85% and 95% at Feekes 6. As it did last year, it appears that the technology will be more accurate on the well drained Pembroke soil. The fewer outside factors that

effect growth (severe weather, drainage, diseases, etc.), the more accurate the readings will be when used for VRN. The height of the curve (difference between highest and lowest NDVI) is also greater on the well-drained Pembroke soil this year which will result in a more accurate interpretation. This indicates that the technology may be better used on well drained soils on wetter years. The excessive moisture put substantial stress on the wheat growing on the more poorly drained Zanesville soil which means nitrogen explains a smaller amount of the differences in the yield variation. The extended cool moist early spring retarded the beginning of the spring growth period. This resulted in a fairly low coorelation of NDVI and subsequent yield for the Feekes 5 readings. This seems to indicate that there will be years when VRN at Feekes 5 will not be as reliable as we might want them to be.

***Nitrogen Rates And Yield***

It appears that a 150 lbs/ac of N was the rate needed for maximum yields this year. The data is seen in figures 1 and 2. This is higher than that usually required. It is felt this extra nitrogen was required this year due to some nitrogen loss with the excessive rains as well as the extended cool spring that delayed growth and reduced N mineralization. The yields were very good. The excellent weather conditions in May were probably the main factor in the outstanding yields.

**TABLE 1. GREENSEEKER/N WHEAT DATA AND ALGORITHMS 2008-2009**

| Feb. N | NDVI | | NDVI Difference | | March N needed | NDVI Algorithm | |
|---|---|---|---|---|---|---|---|
| Lb/ac | F5* | F6* | F5* | F6* | Lb/ac | F5* | F6* |
| | | | | | | | |
| PEMBROKE SOIL | | | | | | | |
| 0 | 0.358 | 0.403 | 0.153 | 0.349 | 150 | Unreliable Data | >0.26 |
| 30 | 0.450 | 0.563 | 0.061 | 0.189 | 120 | | 0.115-0.26 |
| 60 | 0.503 | 0.694 | 0.008 | 0.058 | 90 | | 0.035-0.115 |
| 90 | 0.511 | 0.732 | 0.0 | 0.020 | 60 | | 0.015-0.035 |
| 120 | 0.511 | 0.754 | 0.0 | 0.0 | 30 | | 0.055-0.015 |
| 150 | 0.477 | 0.752 | 0 | 0 | 0 | | <0.005 |
| | | | | | | | |
| ZANESVILLE SOIL | | | | | | | |
| 0 | 0.480 | 0.450 | 0.079 | 0.268 | 150 | Unreliable Data | >0.205 |
| 30 | 0.547 | 0.567 | 0.012 | 0.151 | 120 | | 0.0125-0.205 |
| 60 | 0.544 | 0.653 | 0.015 | 0.065 | 90 | | 0.085-0.125 |
| 90 | 0.538 | 0.626 | 0.021 | 0.092 | 60 | | 0.055-0.085 |
| 120 | 0.500 | 0.658 | 0.059 | 0.060 | 30 | | 0.025-0.055 |
| 150 | 0.559 | 0.718 | 0 | 0 | 0 | | <0.025 |
| *Feekes Growth Stages | | | | | | | |

**Figure 1.**

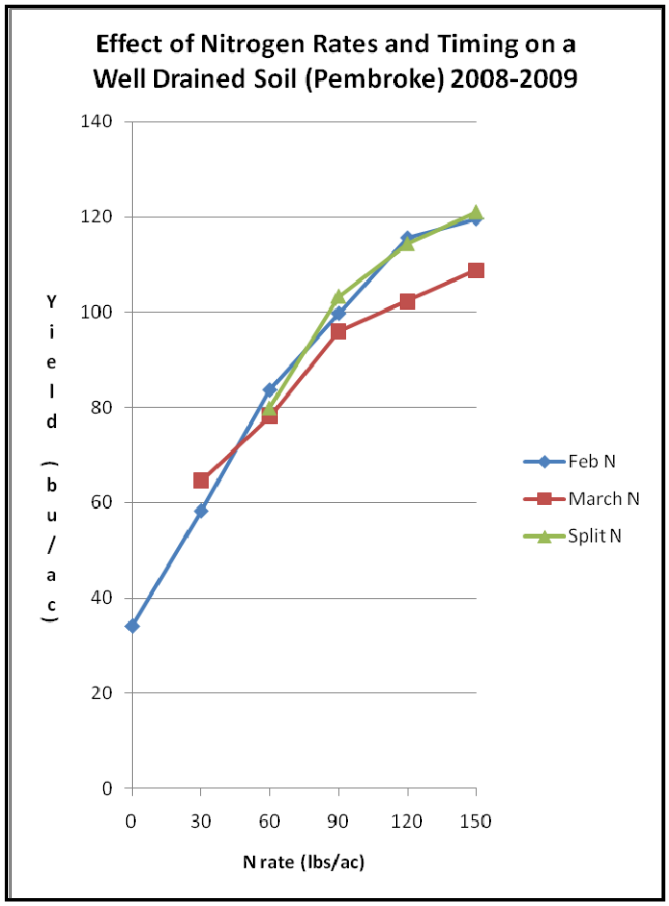


**Figure 2.**