

IMPROVING NITROGEN APPLICATION TECHNOLOGY UNDER KENTUCKY CONDITIONS

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The objective of this study 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.

Method:

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 only for one year so it is preliminary. The Easter freeze also caused the severe damage to the plants and the results of this year may be atypical of that found most years.

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 (figures 1 and 2) and the March nitrogen needed for optimum yield are suspect due to the Easter freeze damage.

The different nitrogen rates explained 49% and 57% of the differences in plant health (NDVI) of the wheat grown on Zanesville and Pembroke soil, respectively, at Feekes 5. It explained 60% and 81% at Feekes 6. It appears that the technology will be more accurate at the later stage of growth and 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 at Feekes 6 which will result in a more accurate interpretation. This indicates

that the technology may be better used at Feekes 6.

**TABLE 1. GREENSEEKER/N WHEAT DATA AND ALGORITHMS
2006-2007**

Feb. N Lb/ac	NDVI		NDVI Difference		March N needed Lb/ac	NDVI Algorithm	
	F5*	F6*	F5*	F6*		F5*	F6*
PEMBROKE SOIL							
0	0.58	0.49	0.15	0.29	120	>0.13	>0.25
30	0.63	0.55	0.10	0.23	90	0.06-0.13	0.18-0.25
60	0.70	0.64	0.03	0.14	60	0.02-0.05	0.10-0.17
90	0.72	0.71	0.01	0.07	30	<0.02	0.04-0.09
120	0.73	0.75	0	0.03	0	0	<0.04
150	0.73	0.78	0	0	0		
ZANESVILLE SOIL							
0	0.34	0.42	0.16	0.27	120	>0.13	>0.20
30	0.40	0.56	0.10	0.13	60 (90)	0.07-0.13	0.10-0.20
60	0.45	0.62	0.05	0.07	60	0.02-0.06	0.05-0.09
90	0.45	0.65	0.05	0.04	30	<0.02	<0.05
120	0.51	0.72	0	0	0	0	0
150	0.50	0.69	0	0	0	0	0

***Feekes Growth Stages**

NITROGEN RATES AND YIELD

It appears that a 120 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 to aid the wheat recovery from the Easter freeze by developing more secondary tillers and filling the heads. The yields were surprisingly good for the amount of damage sustained. The excellent weather conditions after freeze was probably the main factor in the surprising recovery.

PEMBROKE SOIL SITE

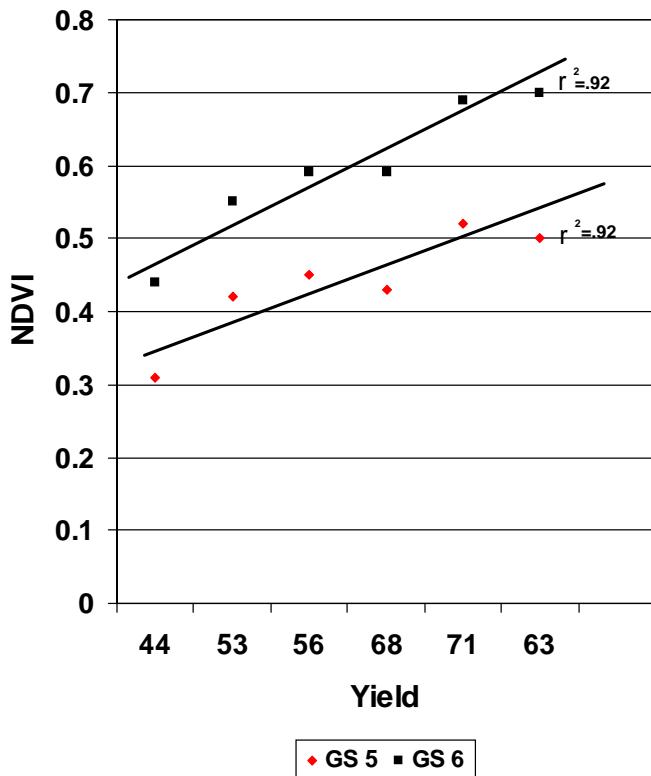
The yields were excellent and all but 1 series of N treatments maximized yields at 120 lb/a N. The yields were highest for the series of N treatments that received 0 or 30 lbs/a N in February. The plants were not quite as far along in plant development with these 2 series allowing it to better withstand the freeze. Also, higher rates of March N were applied just before the freeze to these 2 series of N treatments that may have resulted in more salts in the plant that increased its protection from freeze damage.

ZANESVILLE SOIL SITE

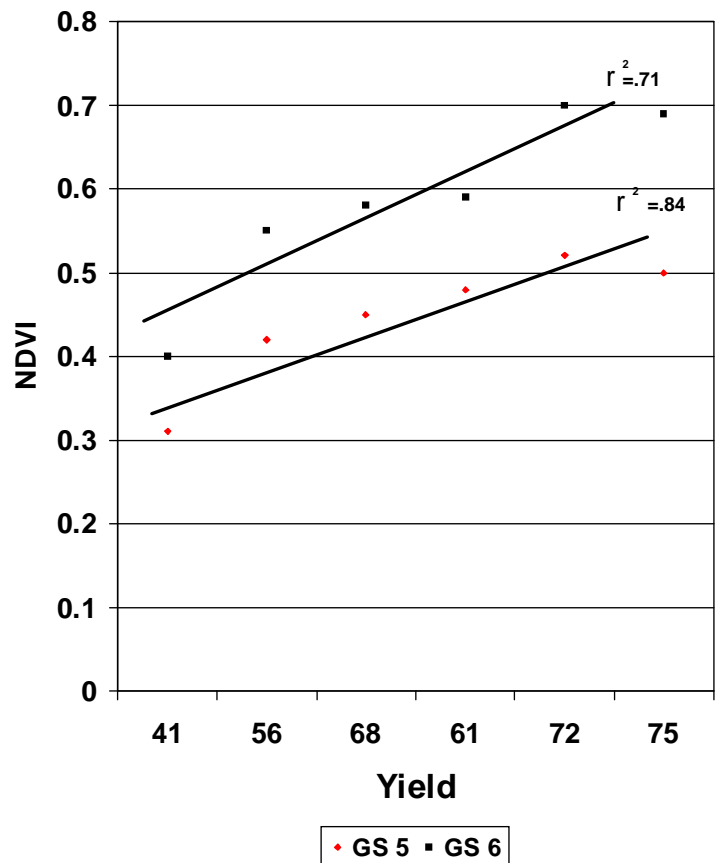
This soil is moderately to somewhat poorly drained which is only marginally adapted for wheat. The cooler and wetter conditions in the fall and early winter slowed the growth rate of the wheat. It was at an earlier growth stage and was less vulnerable to freeze damage.

The most economical efficient N rate to use was 120 lbs/a. There was little difference in yield between the February N series used. However, the highest February N rates (90 + 120 lb/a) yielded a little less, but the differences were small and this trend is usually expected even without a freeze.

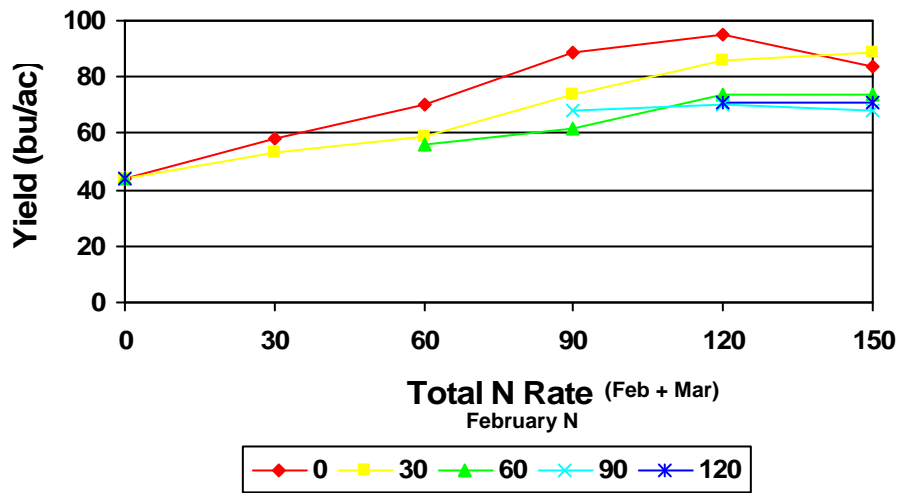
**Greenseeker N Trial 2006-2007
Zanesville**



**Greenseeker N Trial 2006-2007
Pembroke**



Greenseeker 2006-07 Pembroke



Greenseeker 2006-2007 Zanesville

