IMPROVING NITROGEN APPLICATION TECHNOLOGY UNDER KENTUCKY CONDITIONS – 2008

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Objective:
The objective of this study is to: 1) Adapt variable ration nitrogen (VRN) technology experiment (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 for two years so they are still 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. This year was more normal and the curves look much better.

Variable Rate Nitrogen:
The information gathered from the NDVI (normalized difference vegetative index) readings, and the nitrogen needed at Feekes 6 for optimum yields are shown in table 1. The relationships with yield (figure 1) show a nice nitrogen response.

The different nitrogen rates explained 67% and 90% of the differences in the NDVI readings (plant health) of the wheat grown on Zanesville and Pembroke soil, respectively, at Feekes 5. It explained 78% and 89% at Feekes 6. 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 NDVI readings will predict the amount of N needed at the Feekes 6 N

application. 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 yields. 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.

Nitrogen Rates and Yields

It appears that a 120 to 150 lbs/ac of N was the rate needed for maximum yields this year. The data is seen in figure 1. 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 some root damage from excessive soil moisture on the Zanesville soil. A total of almost 28 inches of rain fell in February, March, April and May. The yields were fantastic. The excellent weather conditions after the wet February and March were probably the main factor in the outstanding yields.

Pembroke Soil Site

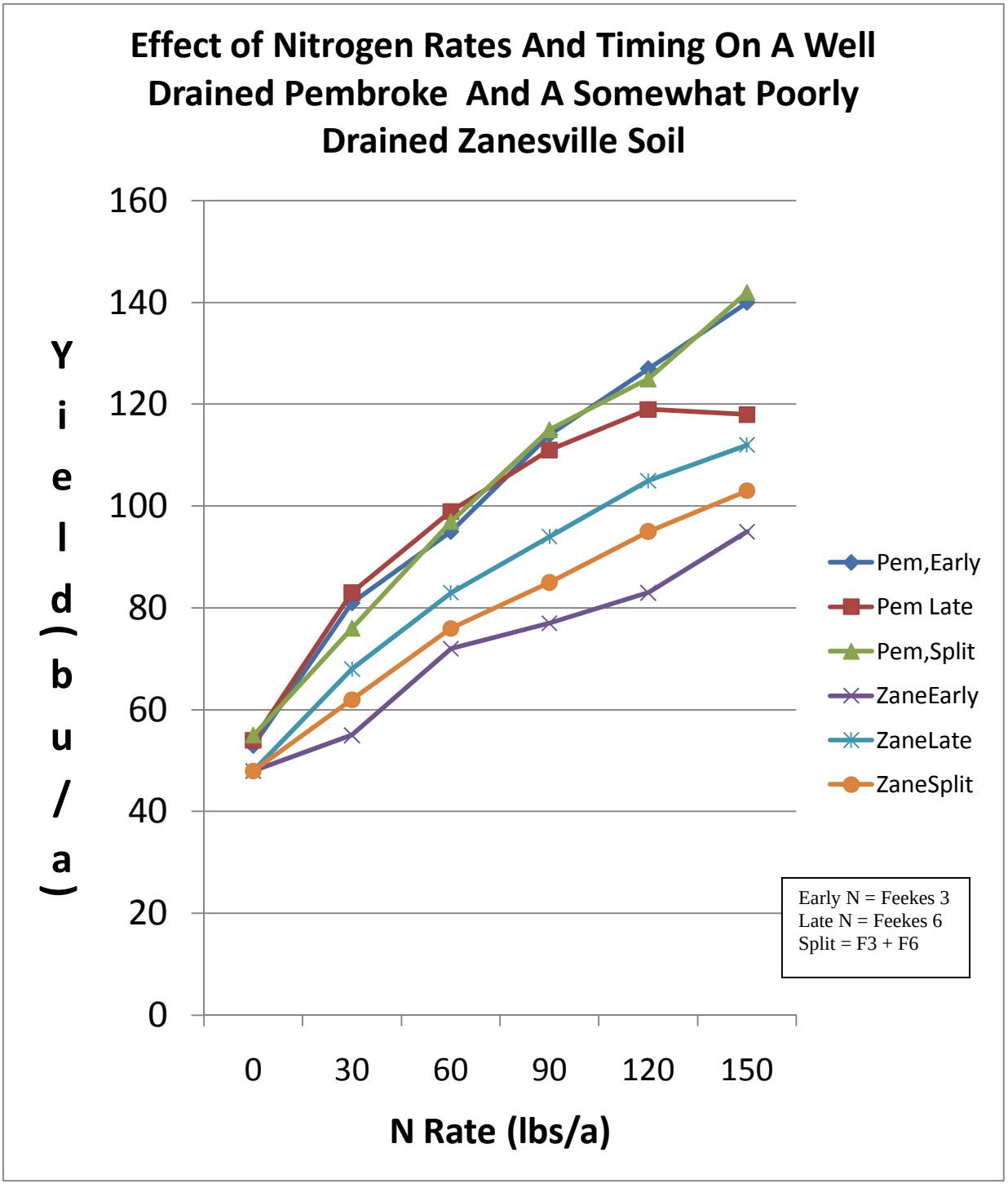
The yields were excellent. Profit and yields were maximized at about 120 lb/a N. The late N application yields plateaued below the early and split treatments. This is unusual and is probably due to excessive rains that caused an early N deficiency.

Zanesville Soil Site

This soil is moderately to somewhat poorly drained which is only marginally adapted for wheat. The root systems were severely damaged by the excessive rains in February and March. Late applications of nitrogen were very beneficial.

TABLE 1. GREENSEEKER/N WHEAT DATA AND ALGORITHMS 2007-2008

Feb. N	NDVI		NDVI Difference		March N needed	NDVI Algorithm	
Lb/ac	F5*	F6*	F5*	F6*	Lb/ac	F5*	F6*
PEMBROKE SOIL							
0	0.47	0.50	0.25	0.30	120	>0.21	>0.20
30	0.60	0.63	0.11	0.14	100	0.13–0.21	0.11–0.20
60	0.61	0.71	0.10	0.06	70	0.06-0.13	0.05-0.11
90	0.69	0.74	0.02	0.03	40	0.03-0.06	0.03-0.05
120	0.70	0.75	0.01	0.02	20	0.01-0.03	0.01-0.025
150	0.71	0.77	0	0	0	<0.01	<0.01
ZANESVILLE SOIL							
0	0.53	0.49	0.14	0.18	120	>0.12	>0.15
30	0.56	0.56	0.11	0.12	100	0.09-0.12	0.11-0.15
60	0.59	0.56	0.08	0.11	80	0.07-0.09	0.08-0.11
90	0.61	0.61	0.06	0.06	50	0.04-0.07	0.05-0.08
120	0.63	0.62	0.03	0.05	30	0.02-0.04	0.01-0.05
150	0.67	0.67	0	0	0	<0.02	<0.01
*Feekes Growth Stages							


Effect of Nitrogen Rates And Timing On A Well Drained Pembroke And A Somewhat Poorly Drained Zanesville Soil
Yield (bu/a)
160
140
120
100
80
60
40
20
0
0
30
60
90
120
150
N Rate (lbs/a)
Pem,Early
Pem Late
Pem,Split
ZaneEarly
ZaneLate
ZaneSplit
Early N = Feekes 3
Late N = Feekes 6
Split = F3 + F6