VARIABLE RATE NITROGEN (VRN) APPLICATION ON WHEAT USING THE GREENSEEKER ON A FIELD BASIS, 2012.

L. Murdock, D. Call, P. Needham and Hunt Farms
D. Halcomb, J. Hendricks, and Walnut Grove Farm
S. Patterson and Seven Springs Farm
Plant & Soil Sciences Department
University of Kentucky, Princeton, KY 42445
PH: (270) 365-7541, Ext. 207; Email: lmurdock@uky.edu

OBJECTIVE

The objective of this experiment is to determine if the algorithms for variable rate nitrogen applications found from small plot research in Kentucky will result in improved nitrogen applications and yield when plant sensors are used on a commercial applicator in a large wheat field.

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 Normalized Difference Vegetation Index (NDVI) readings. Basic field research has resulted in reliable algorithms for use on field application.

METHODS

In 2012 several field trials were established with the Greenseeker on 3 farms in cooperation with Phillip Needham, Brandon Hunt, Don Halcomb, Joe Hendricks and Shane Patterson. The 4 Greenseeker sensor units were distributed across the boom. The units were rigged to give an average NDVI reading across the full length of the boom and N rates changed across the entire boom as called for by the averaged NDVI readings. The algorithm used was the one averaged across 2008, 2009, 2010 and 2011 on the Pembroke soil type at Feekes 6. The applicator only used pressure to change the 32% UAN liquid volume. So the change was limited to about a 50 lb/a N range (30 to 80 lb/ac N) at 12 mph while depending on pressure changes to change volume flow, the rate changes are slow.

RESULTS

The results obtained to this point are from the Walnut Grove Farm where many comparisons were made with the Greenseeker sensors and the Kentucky algorithm against the farmer practice using a flat rate. Most of the data obtained was for wheat planted after soybeans due to severe damage on most of the wheat planted after corn.

The data are found in Table 1. In every case, the yields and the average N rates were higher with the VRN. The VRN system detected a need for more N than the tiller counts and the color to the eye of experienced agronomists. The yield gains after soybeans were greater than ever expected which resulted in very large dollar returns for using the technology. The yield gains after corn were less and more in line with results from previous years. The results give very good evidence that the VRN technology used is reliable, dependable and profitable.

Table 2 shows the yield results in 2 fields where the 3 different N rates are compared using the 3 different methods of application. Although the results are confound with rates and method of application, the results seem to indicate the reason for the increase in yield was not all due to increased N rate, but some probably due to better N distribution in the field.

Table 3 shows where the 3 different N application methods (flat rate, Kentucky VRN algorithm and

the Oklahoma VRN algorithm) are compared. This data seems to support other evidence that an algorithm must be developed for a specific region.

The Seven Springs VRN comparisons have not been obtained but are scheduled to be obtained on August 8.

The VRN trial completed on the Hunt farm was carried out using Ag Leader Optrx sensors and using their universal algorithm (fits most wheat conditions). The results are found in Table 5. The yields and the average N rates of the Optrx VRN technology were lower in every replication and the dollar returns to the producer were negative.

THREE-YEAR SUMMARY

This is the third year the VRN technology using the Greenseeker has been scientifically tested on a field basis. The results have been positive for VRN in every field (Table 4).

When wheat was planted after corn over the 3 yields in 4 comparisons, the average yield increase was about 3.5 bu/ac. with an increase in N rate of about 18 lb/ac of N. This resulted in a $15/ac return to the technology. When wheat was planted after soybean over the 4 fields and only one year the yield increases were about 18 bu/ac. with an increase of about 24 lb/ac N. This resulted in a $95/ac. return to the technology.

CONCLUSION

1. The NDVI readings provided by the Greenseeker will represent the N status of the wheat crop at Feekes 6.
2. The Kentucky algorithm accurately recommends the additional N needed at Feekes 6.
3. The recommendations made by this Greenseeker/Kentucky algorithm are more consistently accurate than experienced agronomists using present scientific knowledge.
4. The N applied in the wheat field using the Greenseeker/Kentucky technology is better distributed within the field according to need.

THANKS

Special thanks to Hunt Farms, Walnut Grove Farm, Seven Springs Farm and Phillip Needham for allowing us (UK) to be a part of these trials and to the Kentucky Small Grain Grower's Association.

Table 1. Effect on Variable Rate Nitrogen (Greenseeker) on 2012 Wheat Yields, N Rates and Returns							
Field	**Year**	**Yield (bu/ac)**		**N Rate* (lb/ac)**		**Returns* ($/ac)**	
		VRN	**FP**	**VRN**	**FP**	**VRN**	**FP**
Halcomb	**After Soybean**						
Baldwin 1	2012	91.0	81.2	88.5	64.0	+46.55	0
Brown 1	2012	76.6	62.8	81.9	64.0	+73.85	0
Griffin 1	2012	88.8	81.1	88.5	64.0	+33.95	0
Griffin 2	2012	101.3	61.8	86.8	64.0	+227.75	-
Avg.		89.4	71.7	86.4	64.0	+95.52	0
After Corn							
Riggins	2012	74.8	72.2	86.1	64.0	+4.55	0
Seven Springs	-	Data to be obtained on August 8					

* Average N rate for Feekes 6
** $6/bu wheat and $0.50/lb N

Table 2. Comparison of N Rates with Different Methods of Application on Wheat Yields After Soybean				
Field	**Year**	**Yield (bu/ac)**		
		FP* 114 lb/ac N	**VRN* 138 lb/ac N**	**N-Rich** 150 lb/ac N**
Griffin 1	**2012**	**81.1**	**88.8**	**78.9**
Brown	**2012**	**62.8**	**76.6**	**70.1**

*** Split application at Feekes 3 and 6**
**** All N applied at Feekes 3**

Table 3. Comparison of Different Methods of Application of N on Wheat After Soybeans				
Field	**Year**	**Yield (bu/ac)**		
		FP*	**KY. VRN**	**OK. VRN**
Griffin	**2012**	**61.8**	**101.3**	**74.3**

Table 4. Three-year Summary of Field Trials Comparing VRN (Greenseeker) with Flat Rate Farmer Practice							
Producer	**Year**	**Yield (bu/ac)**		**N Rate* (lb/ac)**		**Returns* ($/ac)**	
		VRN	**FP**	**VRN**	**FP**	**VRN**	**FP**
	After Corn						
Hunt	2010	84.2	79.3	69.0	45.0	+17.40	0
Hunt	2011	97.4	92.5	51.1	52.3	+30.05	0
Hunt	2011	84.2	82.2	54.1	53.2	+11.60	0
Halcomb	2012	74.8	72.2	86.1	64.0	+4.55	0
Avg.		85.2	81.6	65.1	53.6	+15.90	0
After Soybean							
Halcomb	2012	91.0	81.2	88.5	64.0	+46.55	0
Halcomb	2012	76.6	62.8	81.9	64.0	+73.85	0
Halcomb	2012	88.8	81.1	88.5	64.0	+33.95	0
Halcomb	2012	101.3	61.8	86.8	64.0	+227.75	0
Avg.		89.4	71.7	86.4	64.0	+95.52	0
* Average N rate for Feekes 6 ** $6/bu wheat and $0.50/lb N							

Table 5. Effect on VRN on Wheat Yield Using Optrx Sensors and Ag Leader Algorithm on Hunt Farms							
Field	**Replication**	**Yield (bu/ac)**		**N Rate* (lb/ac)**		**Returns* ($/ac)**	
		VRN	**FP**	**VRN**	**FP**	**VRN**	**FP**
Home 5	1	85.6	90.8	50	65	0	+23.70
Home 5	2	87.8	92.5	50	65	0	+22.50
Home 5	3	82.8	89.2	50	65	0	+30.90
Home 5	Avg	85.4	90.8	50	65	0	+25.70