USING SENSOR DATA TO EVALUATE EARLY SEASON PEST CONTROL STRATEGIES

E. Burris
Northeast Research Station, LSU Ag Center
St. Joseph, LA
D. Burns
Tensas Cooperative Extension Service, LSU Ag Center
St. Joseph, LA
J. E. Jones
Department of Agronomy, LSU Ag Center, Retired
Baton, Rouge, LA
C. Overstreet
Department of Plant Pathology and Physiology, LSU Ag Center
Baton, Rouge, LA

Abstract

A GreenSeeker optical sensing application system effectively measured crop status and variability for early season insecticide/nematicide tests conducted at the Louisiana State University Ag Center's Northeast Research Station, St. Joseph, LA. Plant biomass values as indicated by normalized difference vegetative index (NDVI) were useful in evaluating a host plant resistance test, test differences among seed treatments, the response of fumigation treatments, and plant biomass differences due to in-furrow and side dress granular treatment of Temik 15Gs. NDVI values recorded in a HPR test supplemented vigor ratings, and suitability ratings for cotton lines that were evaluated for *reniform* nematode resistance in 2008. In order to use the GreenSeeker map features, Real Time Kinematic (RTK) GPS was used to help build a Geodatabase that provided precise NDVI values for GIS maps. Data recorded in Farm Works was easily exported in .shp (shape) file format and then incorporated into georeferenced plots.

Introduction

The goal of these experiments was to use GreenSeeker handheld sensors and GreenSeeker mobile mapping sensors during cottons early season growth stage and record pesticide treatment effects on plant biomass. The rational for exploring the use of GreenSeeker sensors was that the data may provide useful NDVI values when collected from early season cotton experiments designed for evaluating differences among seed treatments, experimental host plant resistance lines (HPR), fumigants and/or side dress treatments. The hypothesis that single sensor systems may provide useful supplements to early season data collection and mapping was validated in several test conducted in 2008.

When ratings of changing field conditions during cottons early season growth stages are required and commercial cooperators request vigor ratings as an additional method for separation of treatment effects and/or desire comparisons to standards and non-treated values, the GeenSeeker provides precise data.

Materials and Methods

Cotton seeds were planted on a commerce silt loam soil 22 April, 2008 for test 2 and 3, and 16 May for test 1 and 4. Plot size was twenty four rows (centered on forty inches) by fifty ft. in test 2, and four rows wide in test 3 and 4. One row plots were used in the host plant resistance (HPR) evaluations. Treatments were replicated four times in a RCB. Treatments were applied using a 7100 series John Deere planter equipped with dual cones for delivery of seed and granules. Telone II was applied with a Premier Container System (Chemical Containers, Inc., Lake Wales, Florida) and 6 row applicator equipped with 30 in. coulters. Temik 15G side dress treatments were applied using Horstine granular applicator boxes attached to a 4 row toolbar equipped with two coulters and shanks per row. Rates were controlled by a Rawson Hydraulic Drive. Seed treatment insecticides ratings, evaluations of Telone II fumigant treatments and evaluations of test that contained Temik 15G applied side dress were taken using a GreenSeeker sensor (model number RT 100, NTech Industries, Inc.). NDVI values for each row and plot were recorded.

Test 1. The HPR test includes results and observations on selected longicalyx lines evaluated cooperatively by J.E. Jones and Al Bell in 2008. They were planted in a nursery at St Joseph on soil heavily infested with *reniform* sp.. The field had Cotoran and Prowl applied as pre-emerge herbicide and Cotoran + MSMA as a post-emerge, but the post-emerge was not applied to the block of longicalyx lines because of severe stunting. Vigor ratings by J.E. Jones were made on 6/3, 6/17, 7/7, 7/21, and 8/5. Vigor rating 1 = very poor and 10 = very good. GreenSeeker NDVI values taken on 7/7 are compared to the Vigor ratings. The correlation coefficient (r) between seedling vigor and NDVI on 7/7 was calculated. A relative Production Index is also included: 1 = very poor and 6 = relatively good (Table 1).

Test 2. Avicta Complete Coton was evaluated at the LSU AgCenter Northeast Research Station on a delta silt loam infested with root-knot nematodes. Test results for Telone II (3 GPA) applied as a fumigant treatment in combination with Avicta and compared to Avicta applied alone are provided. GreenSeeker NDVI results for 2008 are included (Table 2).

Test 3. GreenSeeker NDVI sensor ratings were taken 38 DAP and 48 DAP. Data were subjected to ANOVA and means separated according to Ducans New Multiple Range test. Between the initial application and the end of sampling, rainfall amounts of .35, 5.53, and .12 in. occurred (Figure 1).

Test 4. Mobile sensor mapping of Aeris and Avicta seed treatments and Temik 15G side dress treatments were compared. A GreenSeekeer single sensor was attached to the front of a small International tractor and connected to a RTK GPS system. Mapping data was collected with the aid of a Titan RT equipped with Farm Works. Veris apparent electrical conductivity data are included with the test plots that were geo-referenced using RTK GPS. Each row of the test was mapped (Figure 2).

Results

GreenSeeker® optical sensing application system effectively measured plant biomass NDVI values and variability that resulted in early season insecticide/nematicide tests conducted at the Louisiana State University Ag Center's Northeast Research Station, St. Joseph, LA. NDVI values recorded in a HPR test supplemented vigor ratings, and suitability ratings for cotton lines that were evaluated for *reniform* nematode resistance in 2008. The correlation coefficient between seedling vigor and NDVI on 7 July was highly significant (r2 = 0.81). The differences in NDVI values ranged from 0.210 - > 0.600 for selected experimental lines (Table 1) .Plant biomass values as indicated by NDVI, were useful in detecting significant early season growth differences for seed treatments, fumigation treatments, in-furrow granule treatments and side dress treatments. NDVI values recorded at 44 DAP indicated Telone II applied at 3 GPS has significantly more plant biomass as compared to Avicta Complete Cotton seed treatment which had significantly more plant biomass than the non-treated (Table 1). NDVI Values collected for Gaucho and Cruiser were similar at 38 and 48 DAP and were significantly better than the non-treated and numerically better than for Temik 15 G (Fig. 1). Real Time Kinematic (RTK) GPS provided precise mobile mapping NDVI values. Data recorded in Farm Works was easily exported as shape files and then incorporated into geo-referenced plots. The technique provided early season detection of a plant growth response when Temik 15 was applied as a side dress treatment (Fig. 2).

References

Burris, Eugene, Burns, Dennis, McCarter, Kevin S., Overstreet, Charles, Wolcott, Maurice C. 2008. Use of GIS/GPS Technique to Analyze Early Season Treatment Strategies in Cotton. *In* Louisiana Agricultural Science Association Proceedings, pp 19.

Burris, Eugene, Burns, Dennis, McCarter, Kevin S., Overstreet, Charles, Wolcott, Maurice C. 2007. Evaluation of The Effects of Telone II on Nitrogen Management and Yield in Louisiana Delta Cotton. *In* Proceedings. 9th International Conference on Precision Agriculture. 2008, CD ROM

Table 1. Evaluation of AL Bell's Lines for Seedling Vigor, NDVI Values, St. Joseph, LA, 2008

		Vigor Ratings by JEJ1/						NDVI Values, 7/7/082/			Prod. Index1/
Plot	Identification	6/3	6/17	7/7	7/21	8/5	AVG	Ind.#1	Ind.#2	AVG	10/1/2008
64	DeltaPearl (check, no Avicta)	5	5	6	7	8	6.2	434	447	441	5
65	Lonren 1 (comp of elite Lon 1 prog)	2	2	2	2	2	2.0	210	217	214	1
66	Lonren 1S (comp of suscep Lon 1 prog)	5	5	5	5	6	5.2	336	361	349	6
67	Lonren 2 (comp of elite Lon 2 prog)	5	4	4	4	4	4.2	345	358	352	2
68	Lonren 2S (comp of suscep Lon 2 prog)	7	7	8	8	9	7.8	466	458	462	4
69	ME Green (BC1-84,dif branch from L1 & L2)	4	4	3	3	3	3.4	382	383	383	1
70	ME White (BC1-84,dif branch from L1 & L2	2	4	4.5	4.5	5	4.0	294	346	320	2
71	MO Green (BC1-132 Fly,Nemx)	2	3	3	3	4	3.0	292	302	297	3
72	MO White (BC1-132 Fly, Nemx)	4	4	4.5	3.5	4	4.0	338	343	341	2
73	MA (BC1-2Fly,Dp5415,BC7)	6	5	5	5	6	5.4	451	466	459	3
74	MB (BC1-77Fly,same int prod as Lonren2)	5	6	6	6	7	6.0	448	463	456	3
75	MF (BC1-85Fly,least G.long cont to Ch 11)	6	7	7	7	8	7.0	522	567	545	4
76	MN (BC1-122Fly,Dp5415,BC7)	5	7	6	7	8	6.6	436	429	433	4
77	FM 966 (check)*	8	8	8	8	9	8.2	602	638	620	4
115	JAJO 70123-60805	6	5	5	5	5	5.2	476	513	495	__
116	JAJO 70125-60805 (planted to Lonren 1 in 07)	10	9	8	7	6	8.0	658	564	611	__
117	JAJO 70128-60063 (planted to Lonren 2 in 07)	10	9	8	7	6	8.0	693	663	678	__
118	JAJO 70129-60063	6	5	5	5	5	5.2	403	433	418	__

*Seed may have been treated with Aeris
1) Vigor rating: 1 = very poor; 10 = very good
2) NDVI data, collected using GreenSeeker Data Collection and Mapping systems
3) Relative Production Index: 1 = very poor, 6 = relatively good

Table 2. NDVI data collections at 44 days after planting; measuring Insecticide/Nematicide response.

Treatment	Date	DAP	NDVI
Telone II, 3 GPA + Avicta Complete Cotton	29 - May	44	0.822 a
Avicta Complete Cotton	29 - May	44	0.755 b
UTC	29 - May	44	0.459 c
		LSD (P = .05) CV Prob (F)	59.48 5.51 0.0001

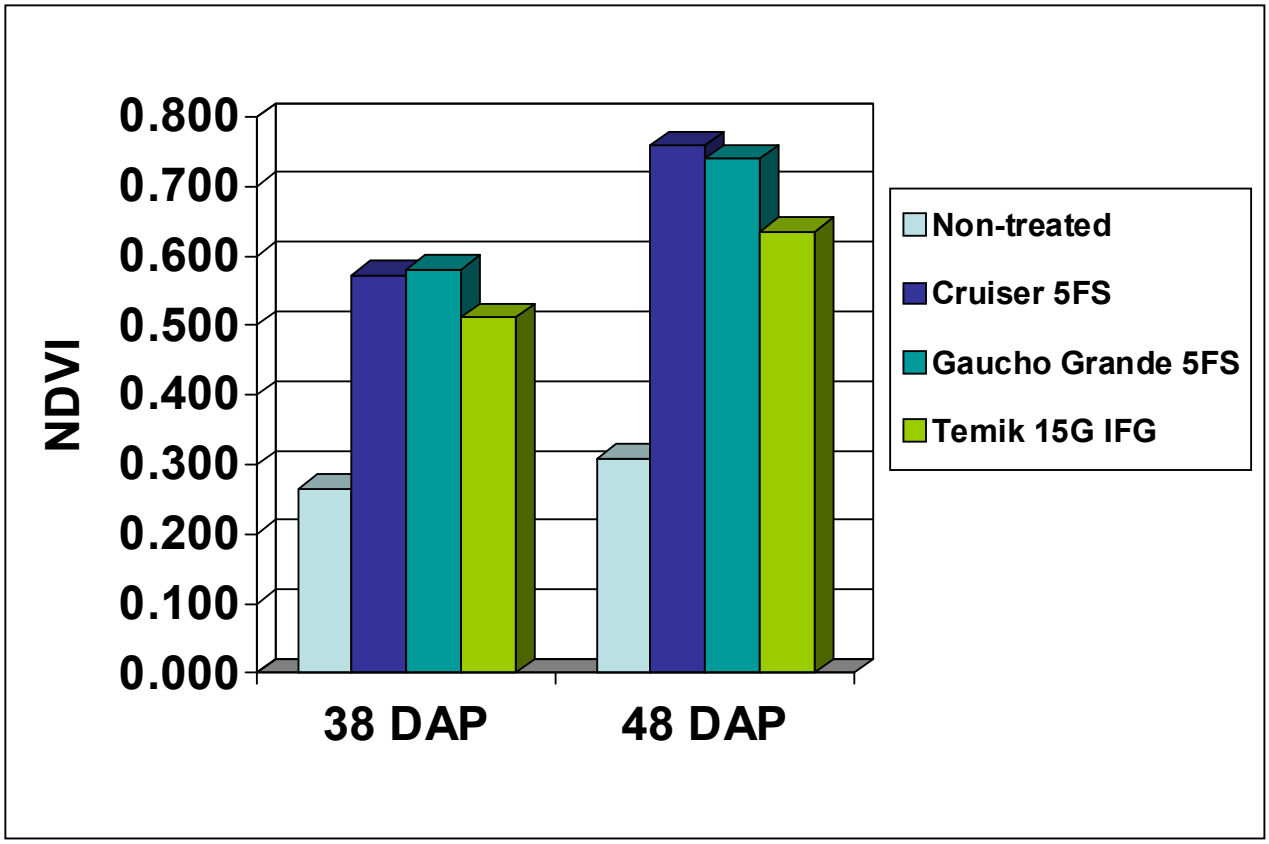

Figure. 1. Early season NDVI values for seed and in-furrow test treatments.

Figure 2. Mobile mapping NDVI values used to detect Temik 15G side dress treatments. The dark blue plots identify the side dress treatments. The mobile unit was connected to a RTK GPS system and mapping data was collected with the aid of a Titan RT equipped with Farm Works. Veris apparent electrical conductivity data are included with the test plots that were also georeferenced using RTK GPS. Each row of the test was mapped.