COTTON AND PEST RESPONSE TO NEMATICIDE-INSECTICIDE COMBINATIONS APPLIED AT-PLANTING ACROSS DIFFERENT SOIL TEXTURES IN A SPATIALLY VARIABLE FIELD – YEAR II

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Abstract

In this 2017 on-farm field trial in NE Arkansas, we investigated plant and pest response to application of four at-planting protectants in a spatially variable field with light textured soils. A base seed-applied insecticide-nematicide, Aeris (imidacloprid + thiodicarb), was used for all treatments. The four at-planting protectants were 1) Aeris, 2) COPeO Prime (fluopyram) +Aeris, 3) Velum Total (imidacloprid + fluopyram) +Aeris, and 4) AgLogic (aldicarb)+ Aeris. The experiment was arranged in a randomized strip plot design with 3 replications. Plant, insect pest, nematode and soil monitoring activities included soil collections at planting and at first flowers, plant and root gall assessments at first flowers, early season whole plant washes for thrips assessments, leaf area determinations, weekly insect pest sampling, plant monitoring with COTMAN and end-of-season mapping with COTMAP. Sample points for the strip trial were based on soil texture classes of loamy sand and coarse sand delineated from measurements using a Veris 3150 EC Surveyor. Nematode assessments made at-planting indicated root-knot and Reniform nematode densities were at threshold levels previously reported to reduce yield by 10% or greater. Low (sub-threshold) insect pest densities (thrips and plant bugs) were maintained season-long using supplemental foliar applications of insecticides. Results indicate there was significant improvements in early season leaf area, and biomass in associated with Velum Total and AgLogic protectants across both soil textures compared to Aeris alone and COPeO+Aeris. Overall, yields were higher for plants in loamy sand compared to plants in coarse sand. There was no significant maturity, yield, or fiber quality differences among at-planting protectants. The on-farm practicality of a pest management program with site-specific use of at-planting protectants will depend on spatial management capacity of the farm, including adequate equipment and technical expertise, as well as size of within-field areas associated with reduced yield potential, and the total application costs for protectants.

Introduction

Use of seed treatments and in-furrow applications of insecticide and fungicide are commonly used as preventative chemical control tactics in cotton pest management programs. If effectively applied, such protectants can lessen pest-induced injury from early season pests of cotton including thrips and nematodes; however, when their costs exceed value of the associated yield or quality gains, even the most efficacious products are too expensive for profitable production. When crop managers employ site-specific approaches rather than broadcast applications, they focus product delivery to field areas where preventative control is economically appropriate. Practical guidelines are needed for crop managers to expand their use of site-specific applications of at-planting protectants. This includes use of management zones, a site- specific approach where a modified input or practice is installed to mitigate a known yield-limiting factor in an identified sub-region of a spatially variable field (Doerge 1999).

Physical and chemical properties of the alluvial soils in the Midsouth greatly impact cotton plant carrying capacity, the boll load that reduces fruit retention and slows squaring node production to zero (Hearn and Da Roza 1985). Soil EC maps coupled with yield monitor data can be used to help confirm that soil properties are a primary cause of limited carrying capacity. Carrying capacity is an important component in plant compensatory response and recovery following pest induced injury. In fields where heterogeneous soils have been identified as the primary cause of limited carrying capacity, one could expect that the associated patterns of spatial variability of compensation capacity also would correspond to patterns of spatial variation in crop benefit from use of protectants. Cotton researchers previously have evaluated site-specific application of protectants for suppression and control of southern root-knot nematodes (*Meloidogyne incognita*) using management zones based on soil physical properties, particularly soil texture (Wheeler et al 1991, Overstreet et al. 2005, Wolcott 2007). When Ortiz et al. (2010, 2012) evaluated variable rate applications of nematicides in management zones delineated using field measurements of soil electrical conductivity (apparent soil EC) as surrogate data for soil texture, they concluded that differences among management zones must exist for the zone application of nematicides to produce differential nematode control and corresponding yield benefits.

Project goals for our research include developing guidelines for precision applications of protectants in site-specific, zone management to improve production efficiency and profitability. We need a better understanding of plant, pest, and soil relationships to develop recommendations for cost-effective, site-specific use of preventive chemical control tactics. This includes use of seed treatments or in-furrow pesticide applications applied at planting. In 2016, we initiated a field trial to investigate both plant and pest response to four different at-planting insecticide-nematicide products in a spatially variable, commercial field in eastern Arkansas. Specific objectives for this study were: 1) examine plant response to at-planting protectants (seed treatments and in-furrow insecticide/nematicide combinations) across different soil textures, 2) quantify pest insect and nematode abundance and impact on earliness, yield and fiber quality with at-planting protectants, and 3) increase understanding of how management zones based on soil EC maps can be used to improve efficiency of pest management practices. In 2016 work, we observed early season, plant response to at-planting application of protectants, but by cutout and harvest, we recorded no significant plant maturity, lint yield, or fiber improvements among the insecticide/nematicide treatments (Mann et al 2017). We did measure a strong relationship of yield and soil texture categorized using soil EC values; however, we saw little benefit for adoption of site-specific application of in-furrow protectants. We repeated the experiment in 2017 and in this paper, we provide a summary of that work.

Materials and Methods

The on-farm study was conducted in Mississippi County, Arkansas in a 17-acre field that had been in continuous cotton production for more than 40 years. Cultivar DP 1518 B2XF was planted on raised beds spaced at 38 inches 16 May 2017 at a seeding rate of 42,000 seed/ac (3 seeds/ft of row) using a 4-row research planter equipped to apply in-furrow protectants. All seed had a base insecticide/fungicide of Aeris (thiodicarb +imidacloprid). For the experiment, there were four protectants: 1) Aeris (base seed treatment), 2) Aeris + COPeO (fluopyram) (seed treatment), 3) Aeris + Velum Total (14 oz/A liquid in-furrow) (fluopyram+imidacloprid), and 4) Aeris + AgLogic (aldicarb) (5 lb/A granules in-furrow). The experiment was arranged in a randomized plot design with 3 replications. Plots were 12 rows wide and 565 ft long (each 12-row swath through the field was ca. 0.5 acres). Other than the at-planting protectants, all other production practices including land preparation, fertilizer application, irrigation, and pest control were performed by the cooperating producers following their standard management regime and using their equipment (Table 1).

Table 1. Dates of planting, irrigation, sampling, foliar insecticide application, and harvest for the 2017 study -- Manila, AR.

Operation	Date	Days after planting
Date of planting	16 May	
Stand counts	23 May, 31 May, 6 June	7, 15, 21
Soil samples (nematodes)	17 May, 17 July	1, 62
Leaf Area Index	31 May, 6 June	15, 21
Producer-applied foliar insecticides	2 June (acephate); 28 June, 14 July, 8 August, (sulfoxaflor), 20 Aug (acephate + bifenthrin)	11, 43, 56, 59, 83
Furrow irrigation	13, 19, 27 July	58, 64, 72
Machine harvest	28 October	171

Plant, insect pest, and nematode monitoring activities were extensive through the season. A stratified, systematic sampling design was used to select the plant and pest sampling sites in each 12-row strip. Strata were defined by soil EC measurements classified as High and Low ranges of soil EC categories in the loamy sand and coarse sand soil textures, respectively. Delineation of soil texture was established from indirect measurements using a Veris 3150 EC Surveyor instrument (Veris Technologies, Inc., Salina, KS). Sample points were identified within each strata, marked with flags and referenced with GPS coordinates. These reference points were used to set 10 ft of row for boll collections for fiber quality and final, end-of-season mapping. No further sampling was conducted in these harvest areas to avoid thigmonasty which could confound yield and fiber quality assessments. Other in-season sampling activities was performed in proximity of these reference points including plant stand determinations and soil samples for nematode assessments.

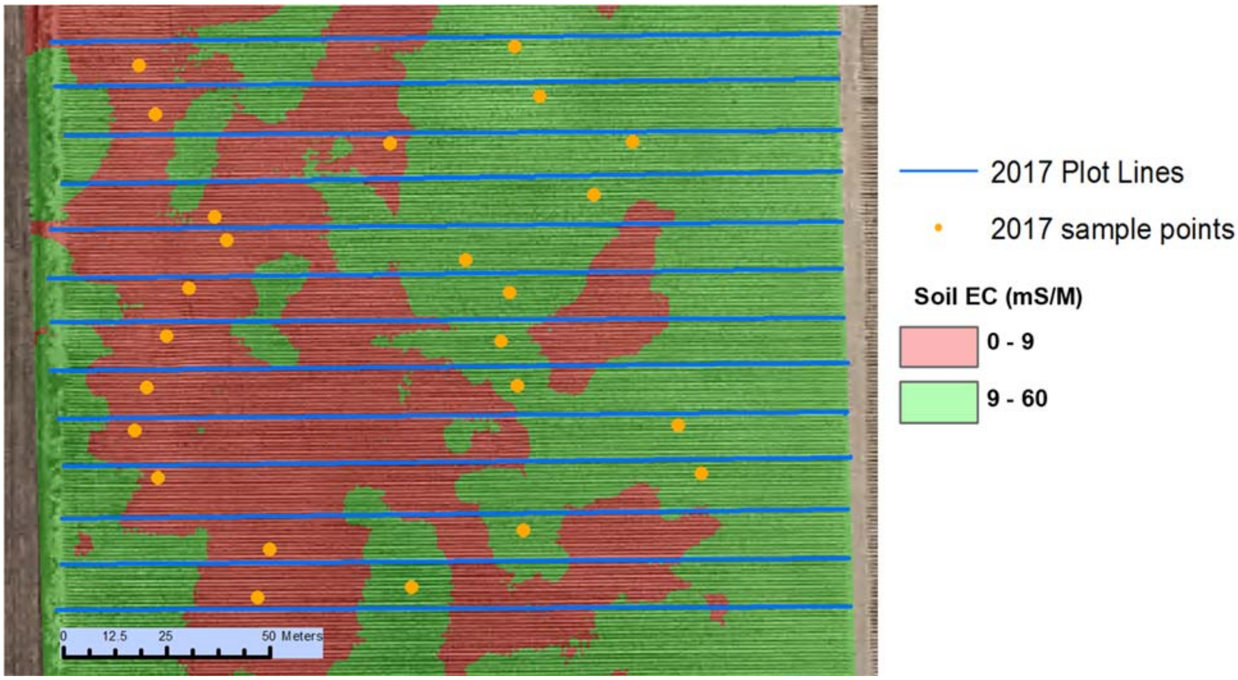

Figure 1. Strip plots overlaid on soil EC map with sample points indicated for each 12-row wide treatment strip; plant and pest monitoring activities in coarse sand and loamy sand within each strip were conducted in proximity of these georeferenced points– Manila, AR, 2017.

Stand counts were made 6 June at 21 days after planting (DAP). Plant stand densities were determined in two, 3-ft transect samples made across each soil textural zone over 12 rows. Soil samples for nematode assessments were collected at designated sample points at 1 DAP and again 62 DAP (week of observation of first flowers). Each sample consisted of 15 soil cores collected within the seed bed and root zone to 8-inch depths using an Oakfield Tube Sampler soil probe. Samples were sent to the Arkansas Nematode Diagnostic Laboratory at the University of Arkansas Southwest Research and Extension Center in Hope, AR. Plants were collected and whole plant washes for thrips made 31 May and 6 June at 15 and 21 DAP. These plants were also used for leaf area index (LAI) determinations which were made using a LI-3100C Area Meter (LI-COR Biosciences, Lincoln, NE). Plant biomass (oven dry weights of whole plants sans root) were also measured. Plant collections also were made at 62 DAP. Sample evaluations for plant height, mainstem nodes, and root gall assessments were made at the A-State Teague Laboratory.

Weekly plant monitoring included evaluations of plant main-stem nodal development, height, and first position square and boll retention using standard COTMAN sampling methods (Oosterhuis and Bourland 2008). Monitoring continued through the effective squaring and flowering periods (Teague 2016). Efficient plant monitoring requires a standard with which to compare actual plant growth. In the COTMAN system, growth curves are generated from field data collections and consist of squaring nodes plotted against days after planting. Growth curves are compared to the COTMAN target development curve, a standard curve, which is assumed to represent an optimum combination of early maturity and high yield (Bourland et al 2008). The standard curve shows main stem squaring nodes through a season, ascending at a pace of one node each 2.7 days through first flower at 60 days after planting, and then descending to physiological cutout at 80 days. The rate of squaring node development after first flower declines in response to an increasing boll load until physiological cutout. This post-flower decline in terminal growth is measured as NAWF (nodes above white flower). Physiological cutout was defined as the flowering date of the last effective boll population. Research in Arkansas has shown that the field or management unit is at physiological cutout when the sampled plant population reaches an average of NAWF = 5 (Oosterhuis and Bourland 2008).

Yield assessments were based on data collected from the cooperating producer's John Deere 7600 cotton picker equipped with calibrated yield monitor with GPS receiver to attain site-specific lint yield. Fiber quality was evaluated using hand-picked bolls (40 consecutive bolls throughout plants including both upper and lower canopy bolls) from georeferenced sample points. Samples were ginned on laboratory gin, and fiber set to the Texas Tech Fiber and Biopolymer Research Institute for HVI evaluations.

Point sample data from the experiment were analyzed as a split plot design with at-planting protectants considered main plots and soil textural classes considered sub-plots. Field level yield data, acquired with the yield monitor, were post-calibrated using final module weights retrieved from the gin. Georeferenced data layers from soil EC and yield monitor were joined in ArcGIS 10.2 (ESRI; Redlands, CA). A two-way factorial protectant structure was used for analysis of the yield monitor measured yield with nematicide/insecticide protectant and block effect and soil EC classifications included as a co-variate. For the final analysis, soil EC values were stratified into two classes, coarse sand (deep <9 mS/m) and sandy loam (> 9 mS/m). These categories initially were based on five classes calculated from soil EC data distributions using ArcGIS 10.2. The EC classes were set using five natural breaks. The four highest EC classes were combined into a category designated loamy sand, and the lowest soil EC class was categorized as coarse sand. Class categories were based on previous experience at the study site as well as historical yield and plant monitoring data. The coarse sand class encompassed ca. 34% of the field. Data were analyzed using PROC GLM and MIXED (SAS Institute; Cary, NC).

Results

With the relatively late date of planting of the 2017 trial, growing conditions were conducive for early season plant development. Plant stand densities measured at 7, 14, and 21 DAP were similar among the four protectant treatments. There were higher stand densities associated with course sand compared to loamy sand (P<0.001) at 7 and 21 DAP (Figure 2). Rainfall amounts during the season were above average (Table 2). Irrigation timing is included in Table 1.

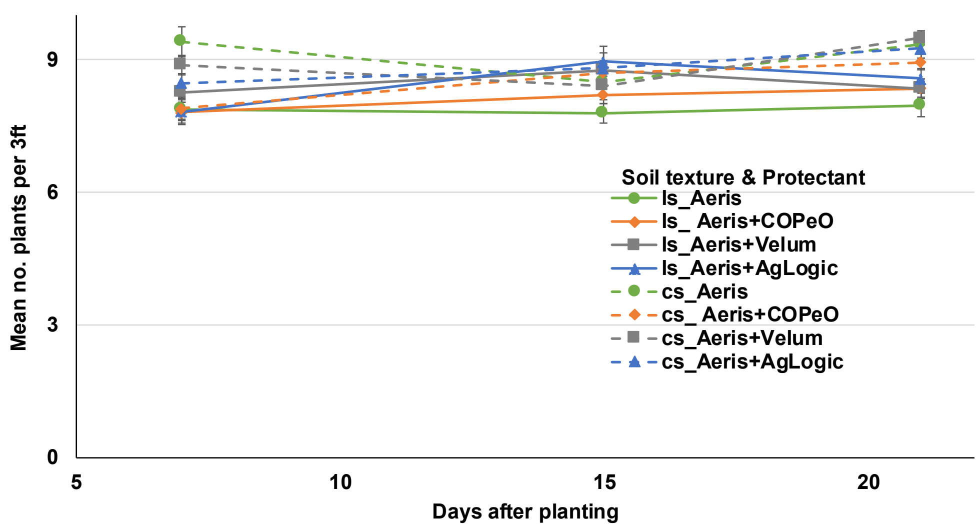

Figure 2. Mean (±SEM) plant stand density, measured as mean no. plants per 3 ft of row measured in two, 3-ft transects across the 12-row plots on 23, 31 May and 6 June (7, 14, and 21 DAP) . Plant stand density differed among soil textures at 7 and 21 DAP (*P*=0.001), but not among at-planting protectants– Manila, AR, 2017.

Table 2. Monthly precipitation (inches) measured at the study site for the 2017 season compared with 30 year average for the county – 2017, Manila, AR.

Month	30 year Average	2017 Rainfall	Departure
	---------------------inches---------------------		
May	5.37	4.87	-0.5
June	3.99	5.46	1.47
July	4.04	5.32	1.28
August	2.36	6.66	4.3
Total Season	15.76	22.31	6.55

Thrips infestation levels were moderately low and below threshold in the 2017 season. An insecticidal response was observed for AgLogic and Velum Total at 15 DAP with significant (P=0.007) reductions compared to Aeris and COPeO + Aeris treated seed (Figure 3). There were no significant differences for soil texture effects (P=0.19) or with protectant*texture interactions (P=0.17). Highest mean thrips numbers were associated with plants collected in coarse sand from Aeris and COPeO + Aeris treated seed in the 15 DAP sample. To avoid potential confounding effects of thrips feeding on our assessments of nematicide effects, we oversprayed the entire experiment at 17 DAP (2 June) with a foliar insecticide. By the 21 DAP sample, thrips numbers were reduced to insignificant levels with no differences among treatments (data not shown).

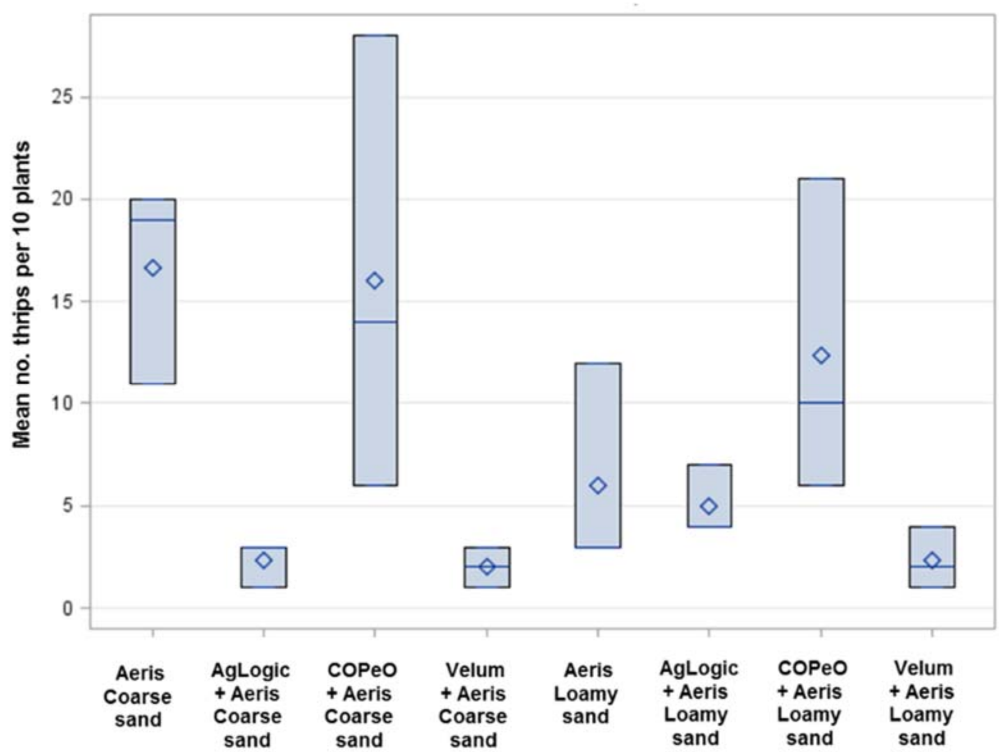

Figure 3. Thrips spp. (larvae and adults) per 10 plants measured from whole plant washes from samples collected 15 DAP in coarse sand or loamy sand for each protectant treatment. Boxes represent 50% quartile; diamonds within the box depict means, and the line is the median value – Manila, AR, 2017.

Plant leaf area measurements at 14 DAP indicate reduced growth for plants in the coarse sand compared to loamy sand soil texture (P=0.02). (Table 3). There also were differences among at-planting protectants (P=0.02). The LAI measurements were lowest for plants in course sand and Aeris only protectant and highest with plants in loamy sand with in-furrow Velum Total or AgLogic. No differences among treatments were apparent by the 21 DAP sample.

COTMAN growth curves for plants from coarse sand show that plant nodal development lagged behind those from sandy loam soil during squaring node development (preflower) and effective flowering stages (Figure 4). There were significantly greater squaring nodes per plant for plants from loamy sand compared to coarse sand at 49, 56, 63 69, 76 and 83 DAP ($P<0.05$). COTMAN growth curves were similar among all protectant treatments through the season. First flowers were observed on the 62 DAP sample date. Squaring node counts at this sample period indicate no differences among protectant treatments (P=0.65), and there were no significant interactions ($P=0.65$) (Figure 5). These data also highlight differences in plant to plant variability between soil textures; there was greater uniformity in plant structure (squaring nodes per plant) among plants from loamy sand compared to plants from coarse sand.

During effective flowering, slope of NAWF decline in growth curves were very similar for plants among protectant treatments. A steeper decline of NAWF values was apparent for plants in coarse sand compared to loamy sand (Figure 4). The flowering date of the last effective boll population was considered date of physiological cutout (NAWF=5).

Mean number of days from planting to physiological cutout (days to cutout) was earlier for plants in samples from coarse sand (75 days) compared to those from loamy sand (84 days). This significant maturity difference (P=0.05) translates into reduced period of effective flowering for plants in the two soil textures. There were no differences in mean days to cutout among protectant treatments (P=0.65), and there were no significant interactions (P=0.65).

Table 3. Measurements of leaf area index from 10 plant samples collected at 14 and 21 DAP for at-planting protectant treatments from either coarse sand or loamy sand – 2017, Manila, AR.

		Leaf area index	
Soil Texture	Protectant	14 DAP	21 DAP
Coarse Sand	Aeris	130.9	1013.1
	COpeO + Aeris	141.4	954.0
	Velum Total + Aeris	144.2	987.1
	AgLogic +Aeris	159.4	952.0
Loamy Sand	Aeris	151.0	817.2
	COpeO + Aeris	144.3	929.8
	Velum Total + Aeris	165.5	1159.3
	AgLogic +Aeris	164.7	1109.6
Pr>F	*soil texture*	*0.02*	*0.92*
	protectant	*0.02*	*0.98*
	*protectant*soil texture*	*0.32*	*0.96*

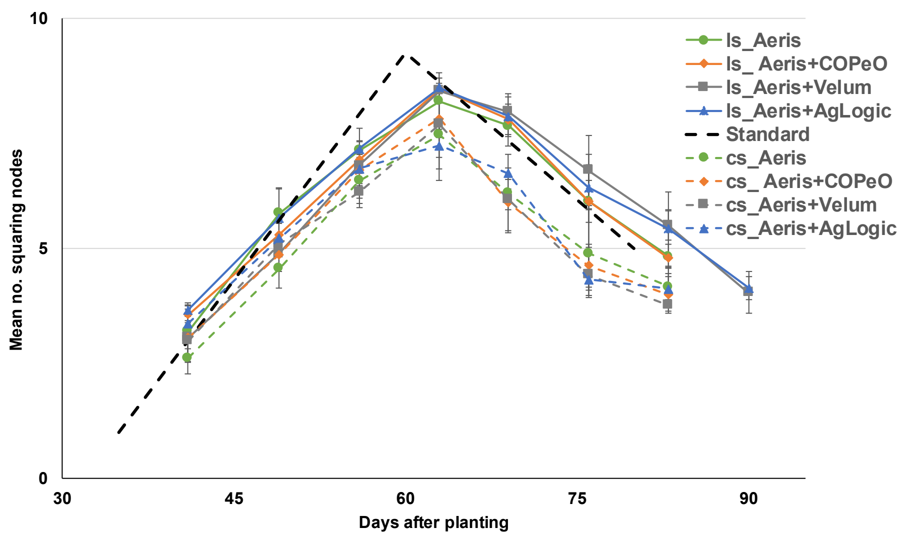

Figure 4. COTMAN growth curves for plants in each protectant treatment in two different soil textures - coarse sand or loamy sand. First flowers were observed at 62 DAP – 2017, Manila, AR.

Plant collections made at 62 DAP showed differences in plant growth associated with soil texture including plant height, counts of main stem sympodia, and total plant dry weight biomass (Table 4). These laboratory assessments made included root-knot nematode gall ratings. There were higher gall counts observed for plants recovered from course sand compared to loamy sand. Results from soil samples for nematodes assessments taken at planting and at 62 DAP showed that overall levels of all nematodes were moderately low for both root-knot and reniform nematode (*Rotylenchulus reniformis*) (**Error! Reference source not found.**); however, these levels are considered the threshold associated with risks of 10% yield loss (Mueller et al. 2012).

Results from analysis of yield monitor measured yields indicated no significant differences in cotton lint yield among the protectant treatments (P=0.84), and there were no significant interactions with protectants and soil texture (P>0.54) (Figure 6). There were significant differences associated with soil texture. Lowest yields were associated with the lowest soil EC values (EC< 9 mS/M) compared to four highest EC classes (>9 mS/m) (Figure 7).

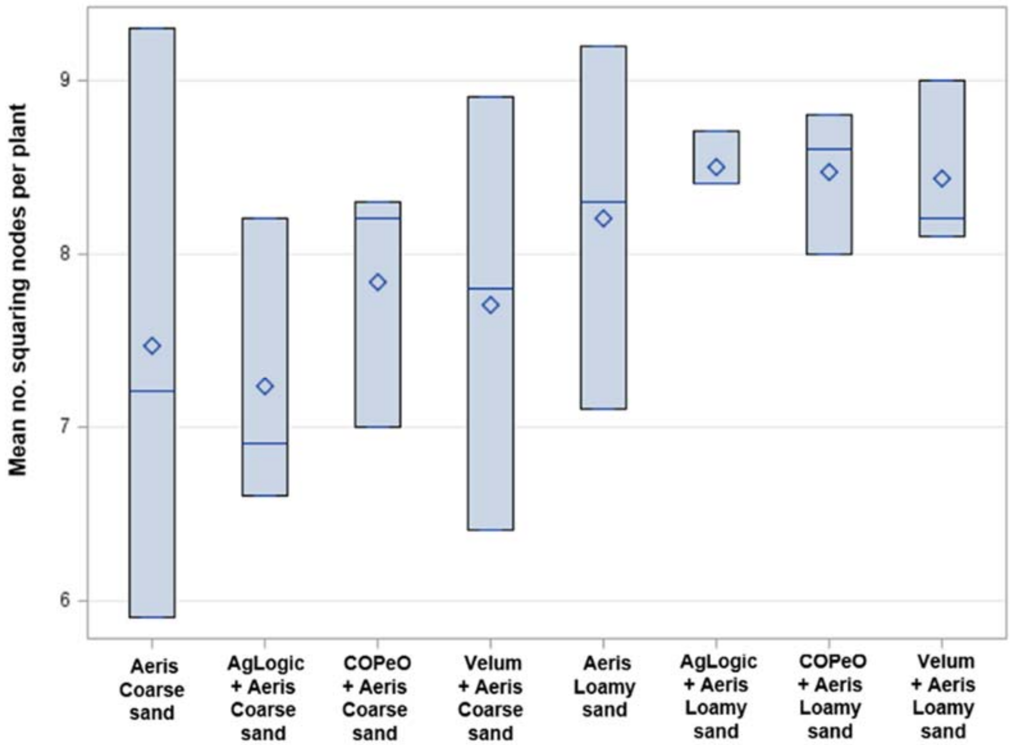

Figure 5. Squaring nodes per plant at the time of first flowers (62 DAP) observed in COTMAN sampling for plants in coarse and loamy sand field sample points for each of the at-planting protectants. Boxes represent 50% quartile; diamonds within the box depict means, and the line is the median value – – Manila, AR, 2017.

Table 4. Mean number of root-knot gall counts per plant[1] along with plant height, number of mainstem sympodia, and biomass (dry weight) of plants collected in each protectant treatment either in coarse sand or loamy sand at 62 days after planting (17 July) -- Manila, AR, 2017.

Soil Texture	Protectant	Height (cm)	Sympodia (no.)	Biomass (g)	Galls (no.)
Coarse Sand	Aeris	45.6	5.7	158.7	7.3
	COpeO + Aeris	44.0	5.4	169.7	6.1
	Velum Total + Aeris	46.7	5.8	165.8	10.2
	AgLogic +Aeris	50.7	6.6	176.7	9.1
Loamy Sand	Aeris	61.8	7.8	274.0	0
	COpeO + Aeris	66.4	7.9	265.7	1.2
	Velum Total + Aeris	65.5	7.2	264.0	0.8
	AgLogic +Aeris	72.0	8.1	293.9	1.5
Pr>F	*soil texture*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.001*
	protectant	*<0.0001*	*0.0136*	*0.5626*	*0.0745*
	*protectant * soil texture*	*0.0032*	*0.0854*	*0.859*	*0.1207*

[1]means of 10 plants per plot

Table 5. Mean number of nematodes per 100 cc soil from samples collected on 17 May (1 DAP) and 17 July (62 DAP) among at-planting protectants for coarse sand and loamy sand soil texture – 2017, Manila, AR.

Sample date& Soil texture	Protectant	Dagger	Reniform	Spiral	Stubby root	Stunt	Root-knot
1 DAP		-------------------number per 100 cc soil-------------------					
Coarse Sand	Aeris	0	25	0	0	0	38
	COpeO + Aeris	0	101	67	0	13	51
	Velum Total + Aeris	0	13	38	0	0	38
	AgLogic +Aeris	0	0	25	0	0	13
Loamy Sand	Aeris	0	2499	90	13	0	0
	COpeO + Aeris	0	13	243	0	13	13
	Velum Total + Aeris	0	861	179	13	0	13
	AgLogic +Aeris	0	51	38	0	13	38
Pr>F	*soil texture*		*0.02*	*0.09*	*0.18*	*1.00*	*0.53*
	protectant		*0.01*	*0.04*	*0.43*	*0.28*	*0.71*
	*protectant * soil texture*		*0.05*	*0.50*	*0.59*	*0.30*	*0.89*
62 DAP		-------------------number per 100 cc soil-------------------					
Coarse Sand	Aeris	0	13	13	13	13	859
	COpeO + Aeris	0	0	0	13	13	807
	Velum Total + Aeris	38	205	89	38	13	500
	AgLogic +Aeris	0	25	13	13	38	141
Loamy Sand	Aeris	0	948	102	0	13	128
	COpeO + Aeris	0	910	192	0	13	320
	Velum Total + Aeris	0	1500	51	13	13	51
	AgLogic +Aeris	0	8	115	13	0	153
Pr>F	*soil texture*		*0.09*	*0.12*	*0.22*	*0.42*	*0.02*
	protectant		*0.50*	*0.86*	*0.50*	*0.93*	*0.49*
	*protectant * soil texture*		*0.76*	*0.49*	*0.83*	*0.55*	*0.37*

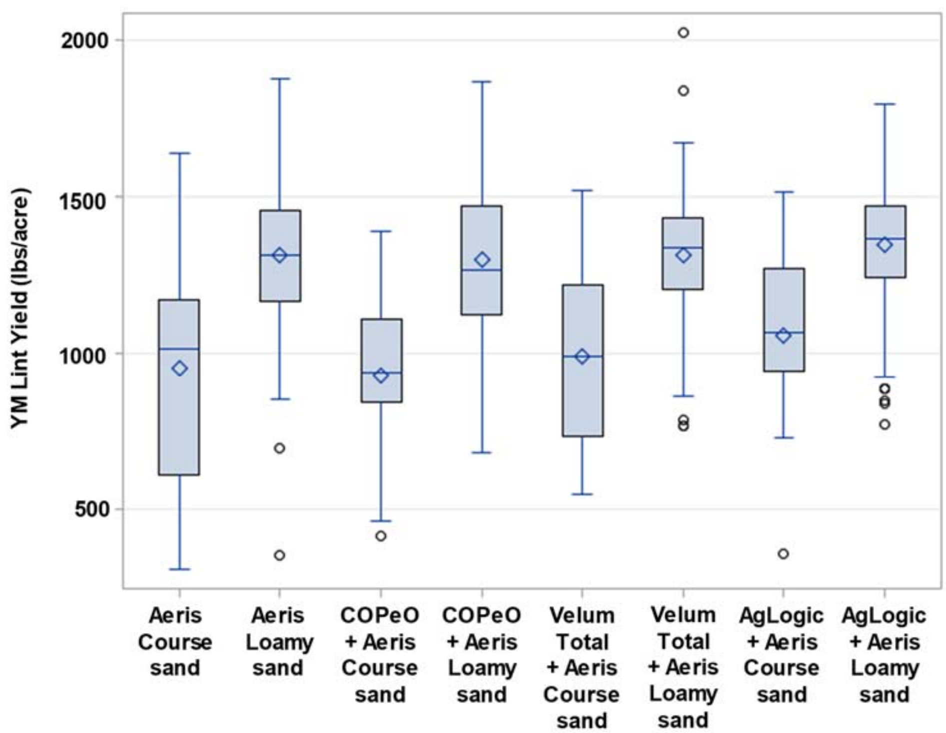

Figure 6. Lint yield among at-planting protectants and soil textures derived from calibrated yield monitor data. Boxes represent 50% quartile; diamonds within the box depict means, and the line is the median value.—2017, Manila, AR.

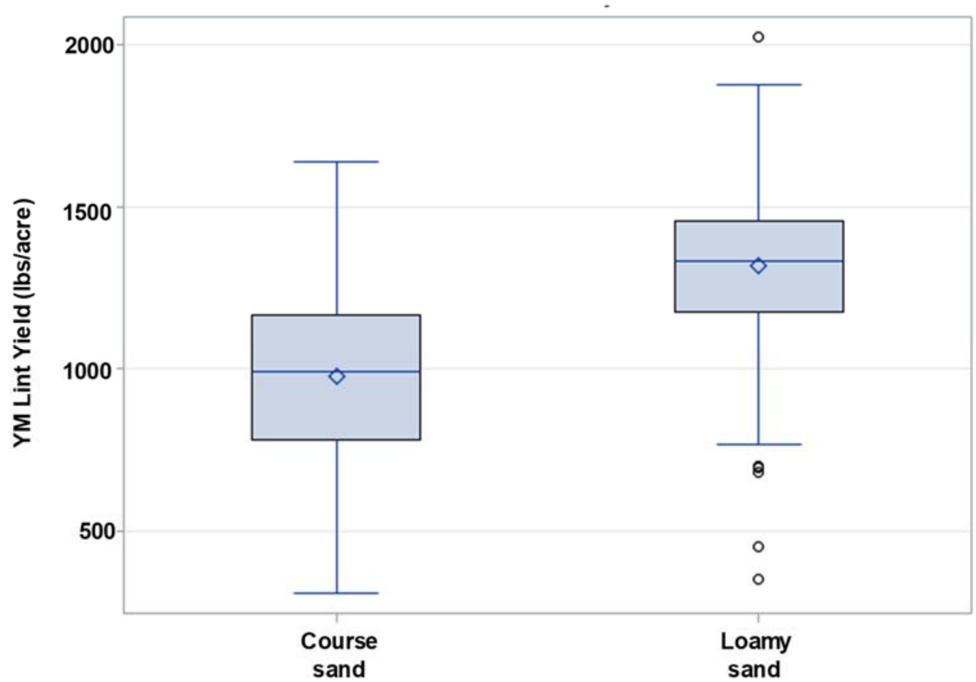

Figure 7. Lint yield for soil texture effects from yield monitor measured yields. Boxes represent 50% quartile; diamonds within the box depict means, and the line is the median value—2017, Manila, AR.

Results from final, end-of-season plant mapping with COTMAP, showed no significant differences in plant structure or boll retention associated with at-planting protectants (P>0.25). There were, however, significant differences observed for plants associated with different soil textures (Table 6). Plants from the coarse sand were smaller, produced fewer main-stem nodes, and retained fewer bolls.

Table 6.Soil texture effects on plant structure and boll retention determined in final, end-of-season plant mapping using COTMAP -- 2017, Manila, AR.

	Mean[1] per plant for soil texture effects			
Category	Coarse Sand	Loamy Sand	*Pr>F*	*LSD_{05}*
1st Sympodial Node	6.3	6.5	*0.24*	
No. of Monopodia	1.7	1.6	*0.93*	
Highest Sympodia with 2 Nodes	8.0	11.5	*0.001*	*0.8*
Plant Height (inches)	24.8	39.3	*0.001*	*2.4*
No. of Effective Sympodia	6.6	10.6	*0.001*	*0.8*
No. of Sympodia	10.9	14.5	*0.001*	*0.8*
No. of Sympodia with 1st Position Bolls	4.9	6.4	*0.001*	*0.4*
No. of Sympodia with 2nd Position Bolls	0.2	1.0	*0.001*	*0.4*
No. of Sympodia with 1st & 2nd Bolls	0.3	1.3	*0.001*	*0.5*
Total Bolls/Plant	6.1	10.6	*0.001*	*1.3*
% Total Bolls in 1st Position	87.5	73.3	*0.03*	*7.9*
% Total Bolls in 2nd Position	7.0	20.9	*0.001*	*5.3*
% Total Bolls in Outer Position	0.5	2.1	*0.02*	*1.2*
% Total Bolls on Monopodia	4.9	3.6	*0.49*	
% Total Bolls on Extra – Axillary	0.0	0.1	*0.34*	
% Boll Retention - 1st Position	47.2	53.2	*0.01*	*4.4*
% Boll Retention - 2nd Position	6.0	19.4	*0.001*	*5.5*
% Early Boll Retention	41.5	49.7	*0.04*	*7.6*
Total Nodes/Plant	16.2	19.9	*0.001*	*0.6*
Internode Length (inches)	1.5	2.0	*0.001*	*0.09*

[1]means of 10 plants per plot.

Results from fiber quality assessments (HVI) from 40 boll hand-picked samples indicated significant differences in several fiber quality parameters associated with soil texture; however, no differences nor interactions were associated with the protectant treatments (Table 7). Micronaire values were significantly higher in collections from plants in the course sand compared to loamy sand (*P*<0.003).

Table 7. Fiber quality assessments (HVI[1]) for 40-boll collections between course and loamy sand textures - 2017, Manila, AR.

Soil texture[2]	Boll weight (g)	Micronaire	Length	Uniformity	Strength	Elongation
Coarse sand	4.2	4.783	1.203	84.492	31.43	6.65
Loamy sand	4.3	4.175	1.200	84.417	30.40	6.86
P>F	*0.55*	*0.003*	*0.86*	*0.81*	*0.06*	*0.21*
LSD_{05}		*0.328*			*1.1*	

[1] HVI assessments made at the Fiber and Biopolymer Research Institute, Texas Tech University, Lubbock, TX.
[2] No significant at-planting protectant or protectant*texture interactions.

Discussion

We measured a strong relationship with plant development, maturity, and lint yield associated with soil texture in our 2017 field trial. Similar results were observed in the first year of the study (Mann et al 2017). Treatment effects from the at-planting protectants were less apparent. We observed some positive plant response to these products in early season. An insecticidal response was observed for AgLogic and Velum Total with reductions in thrips numbers; however, thrips were controlled with foliar insecticide, and their early season feeding injury was insufficient to result in economic damage. We observed significant reductions in reniform nematode numbers following application of AgLogic as well as reductions in root-knot nematode numbers associated with AgLogic and Velum Total compared to the base Aeris and the COPeO+Aeris treatments. Population densities were lowered; however, no significant maturity, yield, or fiber improvements were noted among protectant treatments in response to nematode suppression.

Negative impacts from feeding injury by pests depends on extent of injury as well as plant tolerance and/or compensation capacity. Susceptible plants are most likely to exhibit greatest potential benefit from use of protectants. Monfort et al. (2007) reported a strong relation between root-knot nematode population density, soil texture and yield. Ortiz et al. (2012) suggested a site-specific approach to nematode management based on soil textures if nematode population densities were above action thresholds. If pest levels were sufficiently high to present risk for economic damage, we believe that use of site-specific applications of protectants could be an effective preventative tactic to manage an array of seedling pests in cotton. Benefits from site-specific management should include reduced production costs, improved efficiency, and lower environmental risks. Before embarking on an extensive plan for precision management, crop managers should understand the sources of variability driving crop yield, earliness, and fiber quality and focus on those issues before spending money on what may be unnecessary inputs.

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