THRIPS INJURY, SEEDING RATE, AND COVER CROP MANAGEMENT EFFECTS ON MATURITY AND YIELD OF MIDSOUTH COTTON

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Abstract

In an on-farm, multifactor trial conducted in 2021, we compared cotton production in two cover crop systems commonly used in the Midsouth – a no-till system with a winter cover crop of fall-seeded cereal rye (*Secale cereale*) and a low-till system with a spring cover crop of black oats (*Avena strigose)* seeded into newly reformed raised beds. Within each system, we evaluated early season insect pest and cotton seeding rate effects on cotton growth, maturity, yield, and profit in a field with spatially variable soils. We compared plant response with and without a protective foliar insecticide spray for thrips (*Thrips tabaci, Frankliniella occidentalis*) in cotton cultivar Americot NG 4936 B3XF planted at 3 seeding rates: 1.5, 3 & 4.5 seeds per ft of row (in 38-inch row spacing this was equivalent to 61,901, 41,267, or 20,634 seeds per acre, respectively). Yields in the 100 ft long, 12-row wide plots (6 replications) were measured with a yield monitor on 6-row cotton picker. Because of the spatially variable soil textures in the field, soil electrical conductivity (EC_a) was included in statistical evaluations. We also compared net revenue for each treatment combination using the University of Arkansas Crop Enterprise Budgets.

There were early season differences between cover crop systems in cotton seedling growth with increased leaf area, nodal development, and plant height in the cereal rye system compared to black oats cover crop system. There were no differences in thrips abundance between the winter and spring cover crop systems. Thrips numbers exceeded action threshold; and there was moderate levels of thrips-induced feeding injury in un-sprayed treatments. Plant monitoring results, including COTMAN growth curves, indicated increased variability in plant nodal development and flowering dynamics with thrips-related injury; however, there was no consistent association of crop maturity delays and thrips control treatment. Crop maturity delay, measured as days from planting to physiological cutout, was observed in the black oats system compared to cereal rye, but there were no significant differences associated with other treatments. Cotton yields in 2021 were exceptionally high in the region. There were significant interactions among all treatments. For both cover crop systems, highest lint yield and net returns were observed with a combination of thrips control and use of low to medium cotton seeding rates. Yield results supported current Extension recommendations for seeding rate of 3 seeds per ft of row; however, because of the high costs of traited cotton seed, highest overall returns were associated with lowest seeding rates. Lint yield was reduced in coarse sand soil textures compared to loamy sand soils; however, there was no clear advantage for allocating additional management to implement variable rate planting across different soil textures.

Introduction

Midsouth cotton producers who manage farms with sandy soils commonly use cover crops to reduce damaging effects of wind erosion. For fall-seeded, winter cover crops, they often broadcast or band cereal crops such as wheat (*Triticum aestivum*) or cereal rye (*Secale cereale*). If poor weather precludes fall seeding, then black oats (*Avena strigose)* is the most common choice for a spring-seeded cover crop. General Extension recommendations in Arkansas suggest that cover crops be terminated at least 3 weeks prior to planting cotton to avoid risks from arthropod pests, allelopathy, and to preserve soil moisture. It is not uncommon, however, for crop managers to delay termination if additional spring growth of the cover crop is needed to ensure there is sufficient cover crop residue to protect cotton seedlings from damaging wind.

In this 2021 on-farm study, we examined effects of 2 commonly used cover crops systems on thrips (*Thrips tabaci, Frankliniella occidentalis*) infestation in cotton seedlings and evaluated how injury associated with thrips feeding influenced cotton growth, maturity, and yield. Maturity delays in season-limited production areas of the northern midsouth can result in reduced cotton yield and/or lower fiber quality. The 2021 study also included consideration of cotton seeding rates. Treated, traited (GM) seed is one of the costliest inputs in US cotton production, and there are grower questions about the need to modify cotton seeding rates when planting into cover crops. Specific research questions were: Do seeding rate and cover crop management affect risk of thrips infestations, and what is cotton response and recovery from early season thrips injury in the different cotton systems? Are there opportunities to improve cotton profitability with different seeding rates in spatially variable fields?

Materials & Methods

The study was conducted in northeast Arkansas at the Manila Airport Complex Cooperative Research Farm (35.899070, -90.158591). Soils in the field were classified as Routon-Dundee-Crevasse complex (Typic Endoqualfs). The experiment was a 2*3*2 factorial arranged in a split plot with cover crops systems designated as main plots and seeding rates & thrips control treatments as sub-plots. There were 6 replications. Cover crop systems were 1) fall-planted (broadcast) cereal rye – no till, or 2) spring-planted black oats (banded) – low till. Cotton seeding rates were 4.5, 3, or 1.5 seeds per ft of row with 38-in. row spacing which was equivalent to 61,901, 41,267, or 20,634 seeds per acre, respectively. Thrips control treatments were 1) foliar insecticide spray for thrips control (thrips spray) or 2) no foliar insecticide spray (thrips check). Plots were 12-rows wide and 100 ft long with 10 ft alleys separating plots. One 6-row swath was designated the harvest swath for the 6-row cotton picker, and the second swath was designated for plant monitoring and other sampling activities.

Cereal rye (var. Elbon) was broadcast seeded at 1 bu/ac in cotton 11 November 2020 into standing stalks the day following harvest of the late maturing 2020 cotton crop. The cereal rye cover crop was terminated with herbicides on 5 April 2021. There was no tillage in the cereal rye strips, and the 2021 season was the 4th year for no-till in the cereal rye treatment plots. For the black oats system, after harvest of the 2020 crop, stalks were shredded, and ground fallowed through winter. In March 2021, rows in the spring cover crop treatment plots were re-bedded, and black oats was seeded at 30 lb/ac in row middles (Figure 1). The black oats were terminated with herbicides the day after cotton was planted. Cotton cultivar Americot NG 4936 B3XF was planted 14 May using 12-row variable rate planter. Cotton seed had standard seed-treatments with insecticides, imidacloprid+acephate. All production activities were performed by the cooperating producers with their equipment and following their standard management practices. The only exceptions were seeding and herbicide termination sprays for the cereal rye. Details for timing, rates, and other production details are listed in Table 1.

Table 1. Dates of planting, irrigation, sampling activities, foliar insecticide application, and harvest the for 2021 cover crop*seeding rate*thrips control research study in Manila, AR.

Operation	Date	Days after planting
Cover crops (seeded / terminated)	Cereal rye–10 November 2020 / 5 April 2021 Black oats–16 March 2021 / 15 May 2021	-185/-39 -59/1
Selective burndown- broadleaf weeds	9 March	-66
Date of cotton planting	14 May	0
Stand counts	21, 28 May, 4, 16 Jun	7, 14, 21, 33
Thrips spray- 3 oz/ac Intrepid Edge	11 June	28
Thrips assessments	4, 10, 14 June	21, 27, 31
Cotton seedlings assessments	4, 10, 14, 22 June	21, 27, 31, 39
Plant monitoring with COTMAN	28 June, 2, 6, 12, 16, 20, 27, 29 July, 2, 6, 10, 16 August	45, 49, 53, 59, 63, 67, 74, 76, 80, 84, 88, 94
Percent flowering plants assessments	14, 15, 16 July	61, 62, 63
Mepiquat chloride applications	7 (16 oz), 27 July (20 oz), 11 Aug, (26 oz)	53, 74, 89
Irrigation (furrow)	25 June, 29 July, 5, 11, 26 August, 1 Sept	42, 76, 83, 89, 104, 110
Harvest	19 October	158

Figure 1. Field activities in March showing re-bedding and seeding the spring planted black oats cover crop (left). The no-till, cereal rye cover crop was seeded in standing stalks in fall 2020 (center left). Cotton was planted into re-worked beds with black oats (lower left) or into the no-till, terminated cereal rye (lower right).

Plant Monitoring:

Stand counts were made at 7, 14, 21, and 33 days after planting (DAP) using line-transect sampling to assess success of meeting seeding rate targets. Samplers counted plants per 3 ft in two transects across each 12-row sub-plot. Seedling plant growth assessments consisted of measurements of 10-plant samples collected 21, 27, 31 and 39 DAP and transferred in the cotton laboratory at Arkansas State University, Jonesboro. Measurements included shoot length (height), counts of mainstem monopodial nodes (no. of true leafs), leaf area (LI-3100C Area Meter, LI-COR, Lincoln, NE, US), and dry weight (biomass) (oven-dried, shoots only). COTMAN® plant monitoring activities were initiated at first square and included evaluations of plant main-stem nodal development and first position square and boll retention (Oosterhuis and Bourland, 2008). Standard sampling protocol were used for Squaremap and nodes above white flower (NAWF) monitoring. Plant maturity measurements included calculations of days from planting to physiological cutout (mean NAWF=5) (Bourland et al 2001) and were based on standard output from the COTMAN software. Additional assessments were made the first week of flowering to gauge treatment effects on earliness. To determine % of plants flowering, scouts inspected consecutive plants in rows 5 and 6 of the 100 ft plot each day over 3 days (61, 62, 63 DAP) and made counts of total number of plants required to find 10 flowers. When a flower was observed, scouts made counts of nodes above white flower (NAWF) to estimate mean no. main-stem sympodia at first flower.

Insect pests were monitored weekly starting at seedling emergence and continuing through physiological cutout. Sampling activities for insect pests were restricted to rows 3 or 4 of each plot. During the effective squaring and flowering period of crop development, insect pest numbers (primarily tarnished plant bugs (*Lygus lineolaris*)), were monitored at weekly intervals using sweep net and drop cloth sampling procedures. Thrips assessments were made using whole plant washes with 10 plants collected per sub-plot at 21, 27, and 31 DAP. Plants were washed in the laboratory with ethanol solution to dislodge thrips onto filter paper; thrips were then counted under a dissecting microscope. The washed plant samples were then used for seedling plant growth assessments, as described above. Thrips numbers on seedling cotton exceeded the University of Arkansas Extension action threshold (mean per plant ~1 to 5 adults & larvae), and a foliar application of Intrepid Edge (3 oz/ac) (2.5 lb methoxyfenozide + 0.5 lb spinetoram / gallon) for thrips control was made at 28 DAP in appropriate treatment plots. Thrips count data were analyzed using Proc Mixed (SAS 9.4).

Cotton lint yield assessments were made using calibrated, georeferenced yield monitor data collected from the cooperating producer's John Deere cotton picker. A four-way factorial structure was used for data analysis with seeding rate, cover crop system, thrips control, and block effects. Because of the spatial variability of soils in the study field, soil texture was included as a co-variate. We used soil electrical conductivity (Soil EC_a) as a proxy for soil texture with measurements made using a Veris 3150 EC Surveyor. Georeferenced soil EC_a and yield monitor data layers were spatially joined in ArcGIS Pro (www.esri.com) (Figure 2). Soils were stratified into two classes -- coarse sand (<10 mS m^{-1}) and loamy sand (e 10 mS m^{-1}). Class categories were based on previous experience at the study site, including consideration of historical yield and plant monitoring data. Approximately 35% of the field was classified in the coarse sand category. Analysis of variance was conducted using mixed model procedures (Proc Mixed & Proc GLIMMIX). Means were compared using LSMEANS procedure with the Tukey adjustment (Pd0.05) (SAS Institute; Cary, NC).

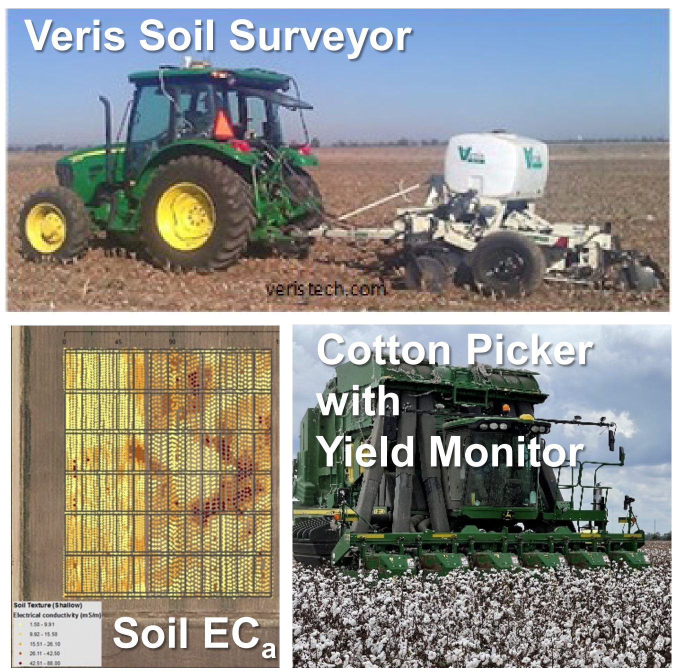

Figure 2. Soil electrical conductivity (EC_a) data were collected at the study site using a Veris Soil Surveyor. Georeferenced soil EC_a and yield monitor data layers were spatially joined in ArcGIS Pro for yield analysis – 2021 cover crop*seeding rate*thrips control study, Manila, AR.

<u>Crop Enterprise Budget Analysis:</u>
The University of Arkansas Enterprise Budget Generator was used to estimate costs and net returns for the study using mean lint yield data. Production and protection inputs were similar among cover crop systems with the following exceptions: seed costs varied for cotton seeding rates and cover crop species, black oats system included costs for an additional tillage operation, and the thrips control treatment included an additional insecticide application. Seed costs for each cover crop system and for the 3 cotton seeding rates are shown in Table 2.

Table 2. Cost estimates for cover crop and cotton seed treatment combinations used in budget analysis of treatment costs for the 2021 cover crop*seeding rate*thrips control study, Manila, AR.

	Cotton seeding rate and cost per acre		
Cover crop seed and cost per acre	1.5 per ft @$58[2]	3 per ft @ $116	4.5 per ft @$173
	-----------------*total cost ($) per acre*[3]------------------		
Black oats[1] @ $4.40	$62.40	$120.40	$177.40
Cereal rye @ $13.60	$71.60	$129.60	$186.60

[1]On farm cost reported by cooperating producer.
[2]Default costs reported in University of Arkansas Enterprise Budget Generator (https://www.uaex.uada.edu/farm-ranch/economics-marketing/farm-planning/budgets/crop-budgets.aspx).
[3]Total cost for each cover crop system + cotton seed combination.

Results

Weather conditions in the 2021 season were favorable for cotton production in Northeast Arkansas. Monthly precipitation for the research area are shown in Table 3.

Table 3. Monthly precipitation (inches) measured at the study site for the 2021 season compared with 30-year average for the county – 2021, Manila, AR.

Mean Month	30 Year Average	2021 Rainfall	Departure
	-------------------------------------*inches*-------------------------------------		
May	5.37	5.37	0
June	3.99	3.04	-0.95
July	4.04	6.87	2.83
August	2.36	2.10	-0.26
September	2.88	2.64	-0.24
Total Season	15.76	17.38	1.62

Stand count results (Figure 3) show that emergence rate and resulting stand density was similar in sub-plots with lo-till, black oats system compared to the no-till, cereal rye. Rainfall patterns were such that soil moisture was not a limiting factor in stand establishment in either the early terminated cereal rye or late terminated black oats cover crop system. In previous research at this site, cotton plant stand establishment and ultimately yield, was negatively impacted by "planting green" compared to planting into a terminated cover crop (Teague et al. 2019, 2020). Target plant stand densities for the lowest seeding rate treatment were ~ 80% by 28 DAP; however, with the operation of the high-speed planter used in 2021, seedling counts in the medium and higher seeding rates were 65 to 75% of target stand densities.

Seedling assessments at 21 and 27 DAP indicated differences in early season plant growth between cover crop systems. Seedlings collected in the cereal rye system had greater leaf area, more true leaves, and increased shoot length (taller) compared to plants from the black oats system (Table 4). There were no differences associated with seeding rate nor were there interactions. Thrips numbers also were similar among the cover crop systems and plant population densities at 21 DAP (Figure 4). By 27 DAP there was a significant interaction with seeding rate and cover crop (P=0.02) with highest numbers of thrips observed in plots with the lowest seeding rate in the cereal rye system.

Thrips numbers were suppressed following the foliar insecticide application made on 28 DAP. Lower numbers at 31 and 39 DAP were associated with the sprayed compared to check plots (P=0.07). Highest overall counts were observed in the check cereal rye treatments. There was not a significant seeding rate (P=0.63) or cover crop*seeding rate interaction (P=0.91). Seedling growth with plants in cereal rye showed no clear effects of injury from thrips feeding at 31 or 37 DAP (Figure 5); however, seedling dry weight, leaf area, main-stem node counts, and plant height were all reduced for un-sprayed check plants for plants in black oats system at 31 DAP and for plant height at 39 DAP (P=0.05) compared to sprayed plants. No significant seeding rate effects were noted until 39 DAP when plant height differences became apparent; taller plants were associated with highest seeding rate (P=0.05). Qualitative damage assessments were made for the plant samples; however, there were no differences among treatments (data not shown).

Other insect pests, including tarnished plant bugs, no measurable effect on fruit retention, yield, or maturity in the 2021 season. Pest numbers were maintained at low levels with insecticides used as needed, season-long.

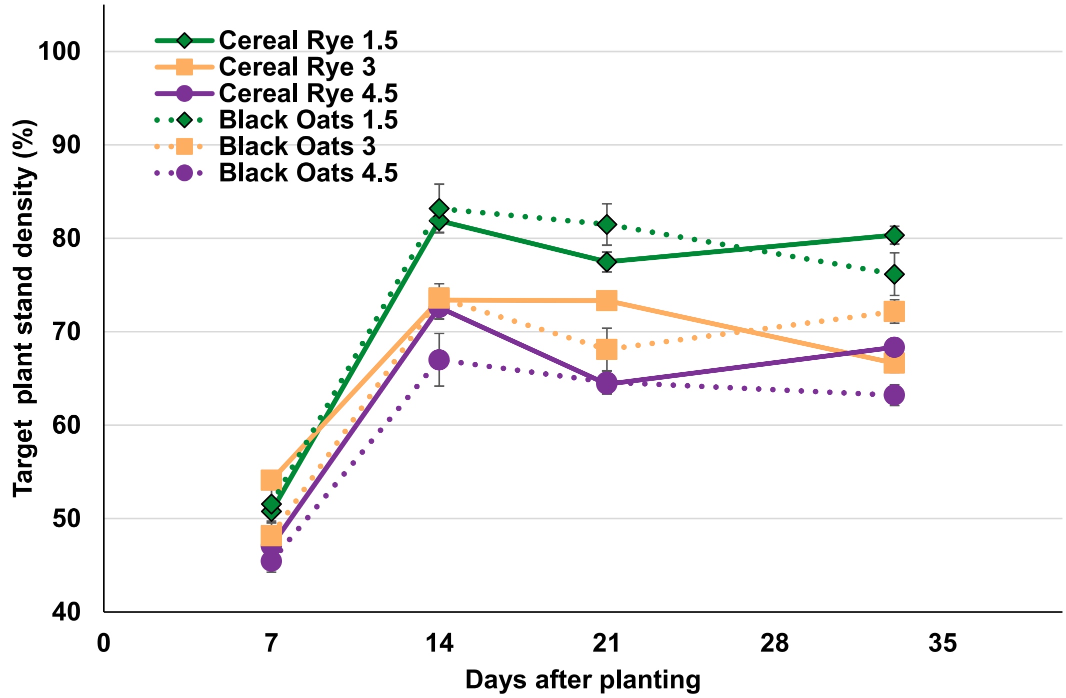

Figure 3. Stand density expressed as % of target stand observed in no-till, terminated cereal rye cover crop (Cereal Rye) and low-till, spring planted black oats (Black Oats) at 3 seeding rates, 1.5, 3, and 4.5 seeds per ft of row-- 2021 cover crop system *seeding rate* thrips control research trial, Manila, AR.

Table 4. Cover crop system main effects[1] for seedling cotton assessments showing mean leaf area, shoot length, plant dry weight, and no. of true leafs for 10-plant samples collected at 21 and 27 days after planting (DAP) – cover crop*seeding rate*thrips control study 2021, Manila, AR.

Cover crop	Sample timing	Leaf area	Shoot length	Dry weight	True leafs
	--days --	*--cm2--*	*--cm--*	*--g--*	*--no.--*
Cereal rye	21 DAP	192 A	5.3 A	1.6 A	0.9 A
Black oats		170 B	4.9 B	1.5 A	0.7 B
Cereal rye	27 DAP	346 A	7.5 A	3.0 A	1.9 A
Black oats		308 B	7.0 B	2.9 A	1.8 A

[1]Means within a column and sample day followed by similar letters are not significantly different (*P*=0.05).

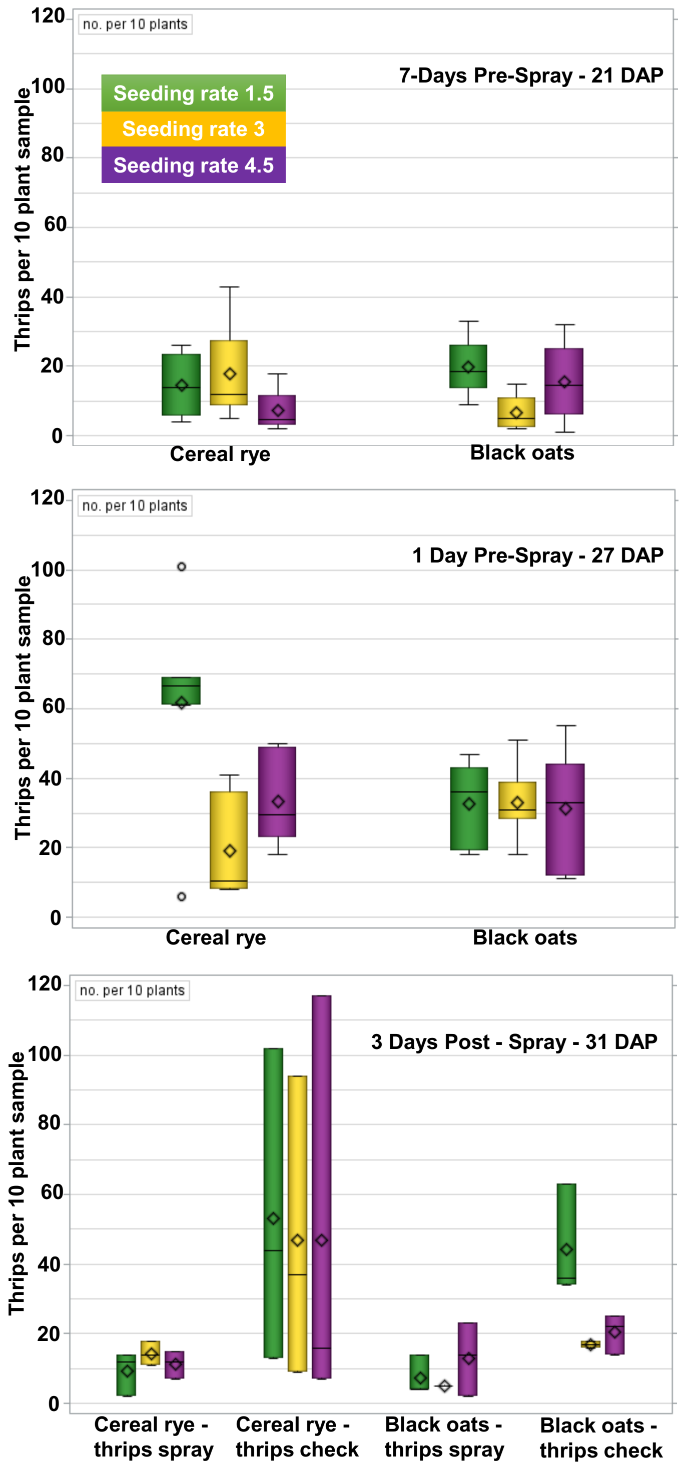

Figure 4. Thrips counts per 10 plants observed in whole plant washes from seedling collections made 7 and 1 day prior to and 3 days after application of Intrepid Edge (sprayed 28 days after planting (thrips spray)) compared to unsprayed (thrips check) treatment plots in either cereal rye or black oats cover crop systems and with 3 different cotton seeding rates, 1.5, 3, or 4.5 seeds per ft of row -- 2021, Manila, AR. The bottom and top edges of the box are located at the sample 25th and 75th percentiles. The center horizontal line is drawn at the 50th percentile (median), and the diamond symbol indicates the mean. Whiskers extend from the box as far as the data extend, to (at most) 1.5 interquartile ranges.

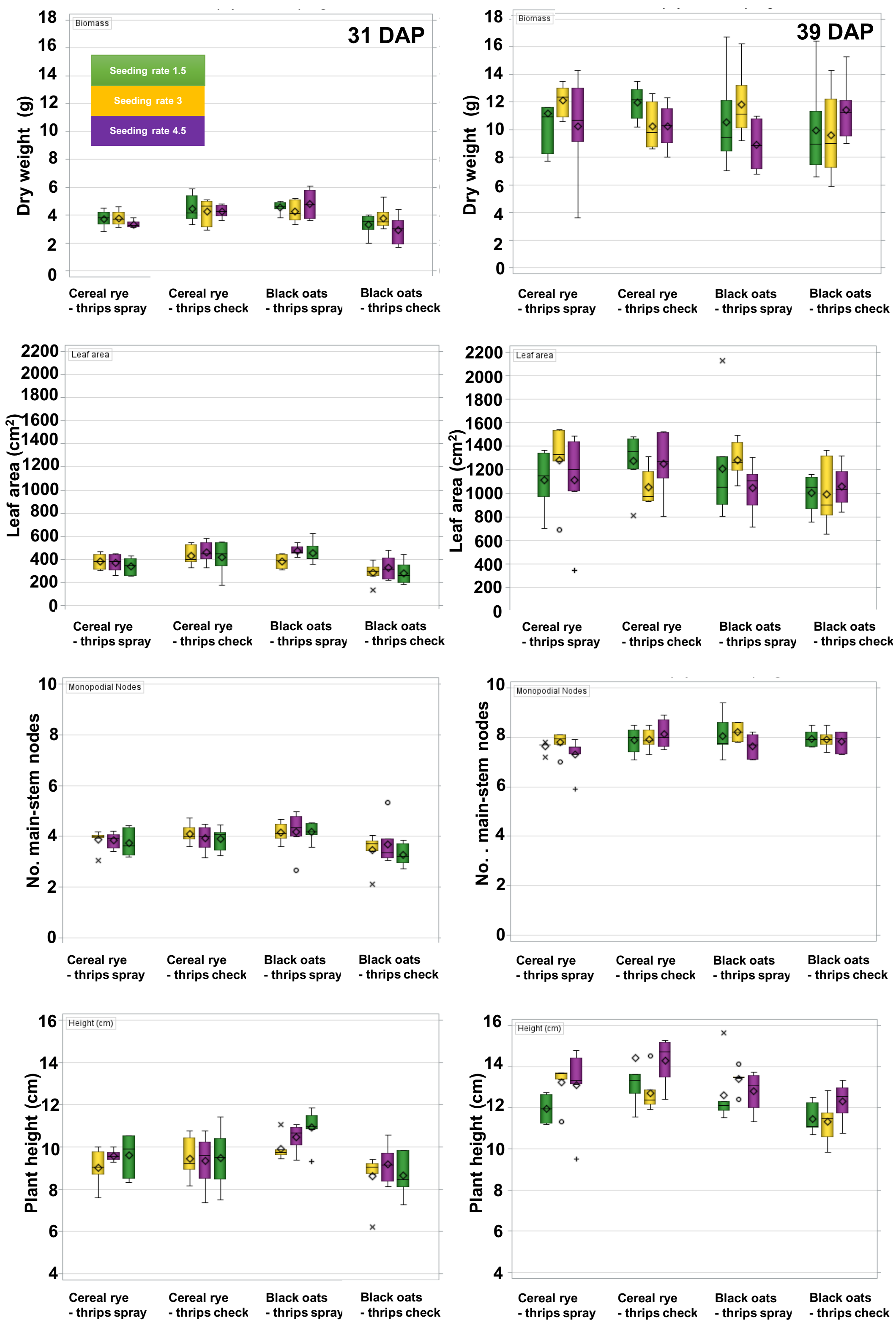

Figure 5. Results from seedling plant assessment for 10-plant samples collected at 31 and 39 days after planting (DAP) following the thrips control spray made at 28 DAP, included seedling biomass (shoot dry weight), leaf area, plant height, main-stem nodes (true leafs), and seedling heights (shoot length) for 3 different cotton seeding rates in either the cereal rye or black oats cover crop system—2021, Manila, AR.

COTMAN growth curves reflected the overall good early and mid-season growing conditions for the 2021 crop season (Figure 6). Main-stem nodal development of plants was similar among seeding rate treatments in both cover crop systems. Pre-flower growth curves generally followed the target development curve. By first flowers at ~ 60 DAP, squaring node counts showed good pre-flower nodal development among all treatments. Slope of COTMAN growth curves after first flower did show indications of seeding rate effects with steepest decent associated with higher plant population densities.

In first flower assessments, mean NAWF values ranged from 9.4 to 8.7 squaring nodes per plant. Mean NAWF for plants in the cereal rye system was 9.0 compared to 8.8 nodes for plants in the black oats. There were no significant differences in NAWF measures among seeding rates (*P*=0.18), thrips control (*P*=0.92), or cover crop treatments (*P*=0.25), and there were no significant interactions (Figure 7). For measures of % flowering, there were differences associated with seeding rate treatments (*P*=0.01) with 15% of plants flowering in the lowest seeding rate compared to 10% and 9% of plants flowering in the mid and highest seeding rates. Early season thrips injury can result in variability in the onset of flowering (Teague 2016), but we measured no differences among thrips control treatments in % flowering during the first week of flowering. There were no cover crop effects or significant interactions (Figure 8).

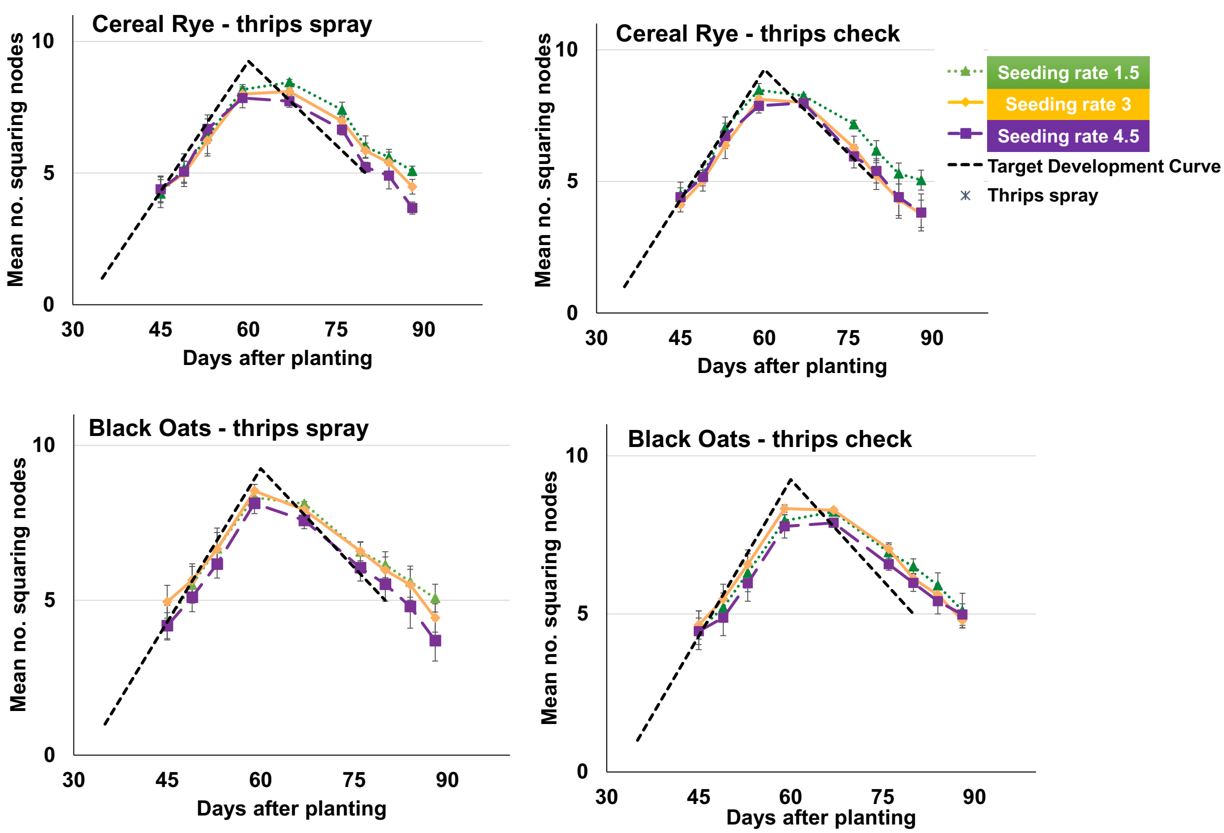

Figure 6. COTMAN growth curves for cover crop systems of cereal rye or black oats with (thrips spray) and without (thrips check) early season thrips spray in comparison with the COTMAN target development curve. Mean squaring nodes (±SEM) were calculated using SQUAREMAP sampling procedures pre-flower and NAWF procedures post-flower -- 2021, Manila, AR.

One gauge of crop maturity is the calculation of days from planting to physiological cutout (days to cutout). No clear thrips control effect was apparent in mean days to cutout, but there were differences between cover crop systems. The mean days to cutout for cotton in the cereal rye system was 84.3 compared to 86.5 for the black oats system (*P*=0.02). Mean days to cutout for the 1.5, 3, and 4.5 seeding rates were calculated to be 86.6, 85.2, and 84.4 days, respectively (*P*=0.07); there was no significant interactions among treatment combinations (Figure 9).

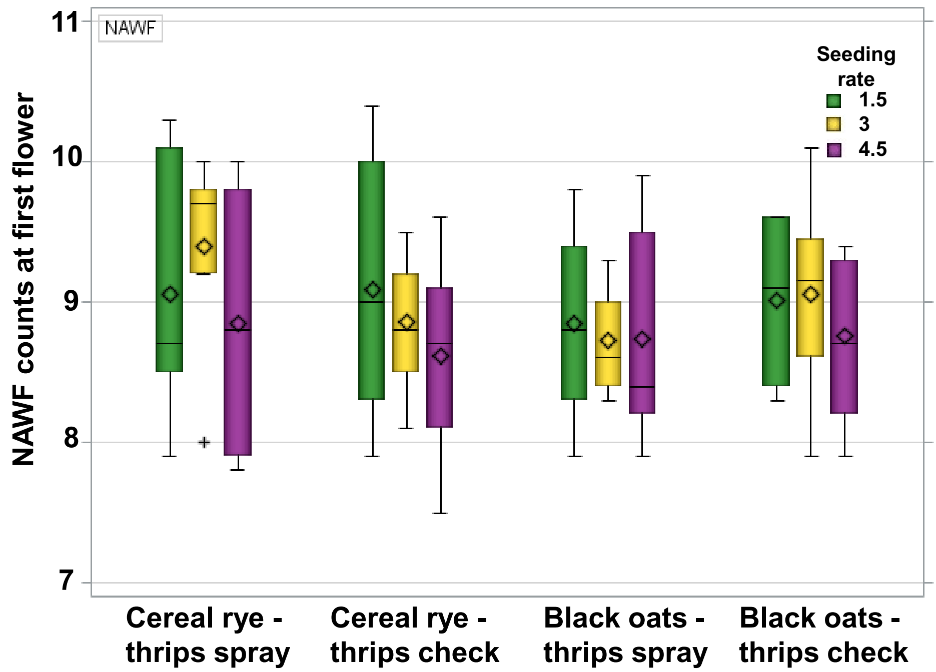

Figure 7. NAWF values for plants observed during the first days of flowering determined on 61, 62 and 63 days after planting for cover crop system, seeding rate and thrips control effects – 2021, Manila, AR.

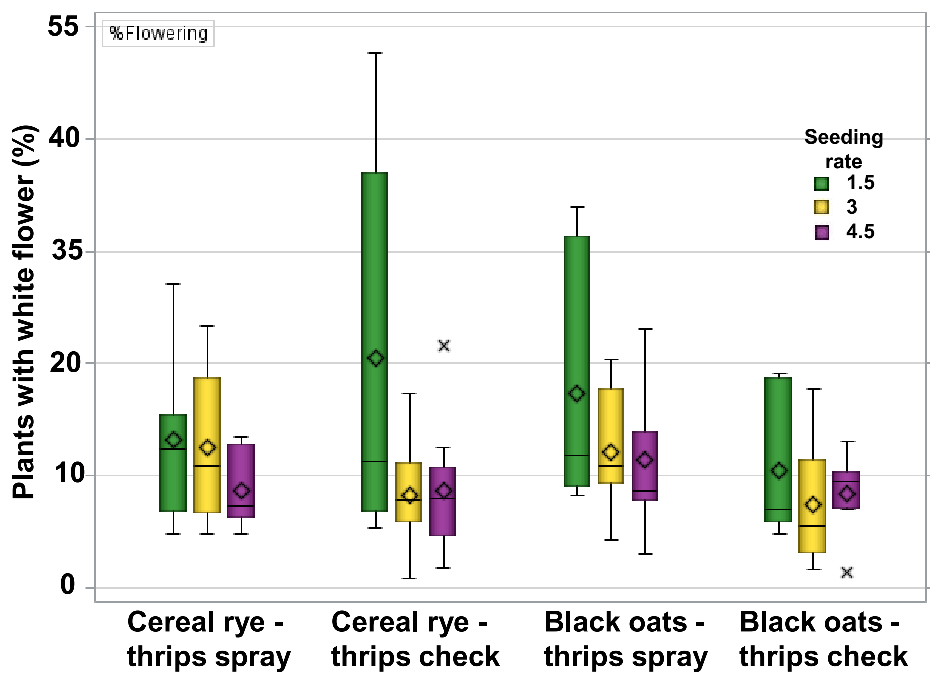

Figure 8. Plants with white flowers (%) observed during the first days of flowering determined on 61, 62 and 63 days after planting for cover crop system, seeding rate and thrips control effects – 2021, Manila, AR.

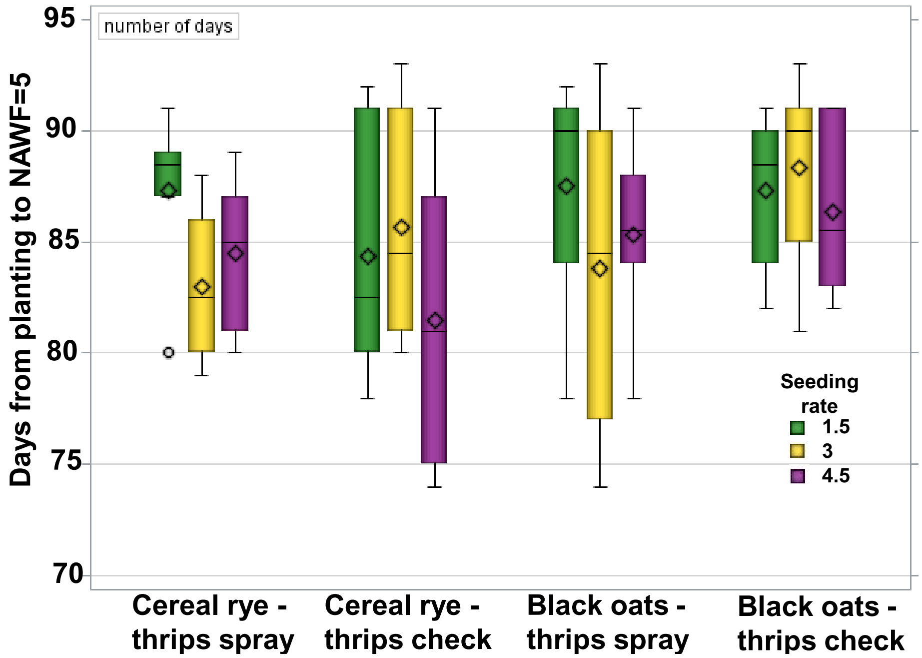

Figure 9. Days from planting to physiological cutout (NAWF=5) for the seeding rate and cover crop system/foliar spray for thrips control-- cover crop*seeding rate*thrips control study 2021, Manila, AR.

Yield Monitor Measured Yields:

Cotton yields in 2021 were exceptionally high across the production region, and in our study, cover crop system, thrips control, and seeding rate effects all significantly affected lint yield. Because of heterogeneous soils in the study field, soil texture was included as a covariant in the yield analysis. There were significant interactions among all factors tested (Table 5).

Table 5. Yield Analysis -- PROC MIXED--Fixed Effects – Yield – Cover crops (CC), thrips control (thrips), cotton seeding rate (SR) and soil texture class (EC_a).

Effect	Num DF	Den DF	F Value	Pr > F
CC	1	1716	2.04	0.1531
thrips	1	1716	22.13	<.0001
CC*thrips	1	1716	16.96	<.0001
SR	2	1716	53.91	<.0001
CC*SR	2	1716	19.17	<.0001
thrips*SR	2	1716	3.15	0.0431
CC*thrips*SR	2	1716	4.29	0.0138
ECa	1	1716	138.36	<.0001
CC*EC_a	1	1716	12.68	0.0004
thrips* EC_a	1	1716	1.88	0.1710
CC*thrips* EC_a	1	1716	10.18	0.0014
SR* EC_a	2	1716	9.73	<.0001
CC*SR* EC_a	2	1716	3.17	0.0421
thrips*SR* EC_a	2	1716	4.93	0.0073
CC*thrips*SR* EC_a	2	1716	7.51	0.0006

Significantly lower yields were associated with plants from field areas with coarse sand soil texture compared to loamy sand (Figure 10). The coarse sand class encompassed 35% of the field. Mean lint yields ranged from a high of 1655 to a low of 1294 lb/acre (Table 6). For both cover crop systems, highest yields were observed with a combination of thrips control and use of low to medium cotton seeding rates. Yield response to seeding rate was inconsistent in treatment combinations. A yield response associated with the thrips spray was most apparent in the cereal rye system in coarse sand soil texture. These data suggest differences in compensation capacity and tolerance to early season, thrips-induced injury for plants in coarse sand compared to loamy sand areas of the field. Spatial variability in pest infestation risk as well as differential plant compensation capacity and tolerance to pre-flower feeding damage has been associated with heterogenous soils in our previous studies (Teague 2016). These results suggest potential opportunities for zone management for crop protection.

Partial Budget Analysis:

Returns to operating expenses (variable costs) calculated using the University of Arkansas Division of Agriculture Cotton Enterprise Budget were based on cotton lint price of $0.90 per lb and mean lint yields. Land costs were included and were the region standard, 25% share rent. The black oats system included an additional tillage operation, and the thrips control treatment included an additional insecticide application. Capital recovery & fixed costs were estimated at $165.90 per acre but were not included in the net revenue calculation.

For loamy sand soils, net revenue of > $400/acre was observed with broadcast cereal rye, a seeding rate of 1.5, or with thrips control and 3 seeds per ft of row and with cereal rye and black oats cover crop systems. Lowest net returns ($125/ac) were observed in coarse sand field areas with the broadcast rye system, with no thrips control and seeding rate of 4.5 seeds per ft of row (Table 6).

Table 6. Mean lint yield and net revene calculations for each cover crop, seeding rate and thrips control treatment combinations from cotton yield monitor measured yields from loamy sand and coarse sand soil textural classes – 2021 , Manila, AR.

Soil texture class	Cover crop	Seeding rate	Mean lint yield[1] Thrips spray	Mean lint yield[1] Check	Net returns per acre[2] Thrips spray	Net returns per acre[2] Check
		seeds per ft of row	*------- lb per acre -------*		*------ $ per acre ------*	
Loamy sand	Black oats	1.5	1512 DEF	1466 EFG	$383	$366
		3	1628 ABC	1581 ABCD	$403	$386
		4.5	1615 ABC	1641 AB	$338	$369
	Cereal rye	1.5	1578 ABCDE	1549 BCDEF	$425	$412
		3	1655 A	1533 BCDEF	$419	$343
		4.5	1609 ABC	1641 AB	$331	$359
Coarse sand	Black oats	1.5	1354 GH	1368 GH	$277	$300
		3	1608 ABC	1555 BCDEF	$390	$368
		4.5	1502 DEF	1578 ABCDE	$261	$327
	Cereal rye	1.5	1448 EFG	1392 FGH	$337	$306
		3	1556 ABCDEF	1464 EFG	$352	$297
		4.5	1527 CDEF	1294 H	$275	$125

[1] Means followed by different letters are significantly different (*P*=0.05).

[2] Capital recovery & fixed costs were estimated at $165.90 per acre but were not included in the net revenue calculation. https://www.uaex.uada.edu/farm-ranch/economics-marketing/farm-planning/budgets/crop-budgets.aspx

Conclusions & Practical Application

In this 2021 field trial, we measured an early season increase in seedling growth in the fall seeded, no-till, cereal rye system compared to spring-seeded, lo-till black oats cover crop system. Plant growth and maturity differences between systems were less apparent by first flowers; however, we did measure a slight yield and maturity advantage with the cereal rye system. Early season thrips abundance was similar in cotton grown in the two cover crop systems, but overall numbers were higher in the cereal rye system. A positive yield and revenue response to the insecticide spray for thrips control was observed in the cereal rye system and was particularly apparent in field areas with coarse sand. There was no significant thrips response associated with different cotton seeding rates.

Yield results in 2021 supported current Arkansas Extension recommendations for seeding rate selection (i.e., 3 seeds per ft of row); however, highest overall profit was associated with lowest seeding rates (1.5 seeds per ft of row). Seeding rate results from this study as well as results from our previous on-farm trials at this research site (Benson et al 2015, 2016 2017, Teague et al. 2016-2021) show that to increase profitability, cotton crop managers should choose the least expensive cotton seeding rate to achieve a stand of at least 1 plant per ft of row. This study and results from our previous work at this site do not support the added cost required to implement variable rate seeding across different management zones defined based on soil textures. Information from plant and pest monitoring activities, yield maps, soil EC_a maps, and aerial imagery are all important tools for setting management zones, but the most important input is experience of the producer and crop advisor to validate the management worthiness of establishing zones.

For decisions on cover crop species choice and management, crop managers should consider the least expensive system that does not delay cotton crop maturity or reduce yield while achieving objectives for wind protection, weed control, and/or soil health and water quality improvements. Highest net returns in this study were observed with a combination of thrips control and use of low to medium cotton seeding rates regardless of cover crop system. An added benefit with the cereal rye system is that crop managers omit spring tillage (re-forming beds), possibly avoiding cotton planting delays associated with variable spring weather. When crop managers expand use of conservation practices that include reduced tillage and cover crops, decision-making should include appropriate cultivar selection and use of pest management practices that promote early vigor and early maturity. An integrated approach will allow producers to improve cotton sustainability.

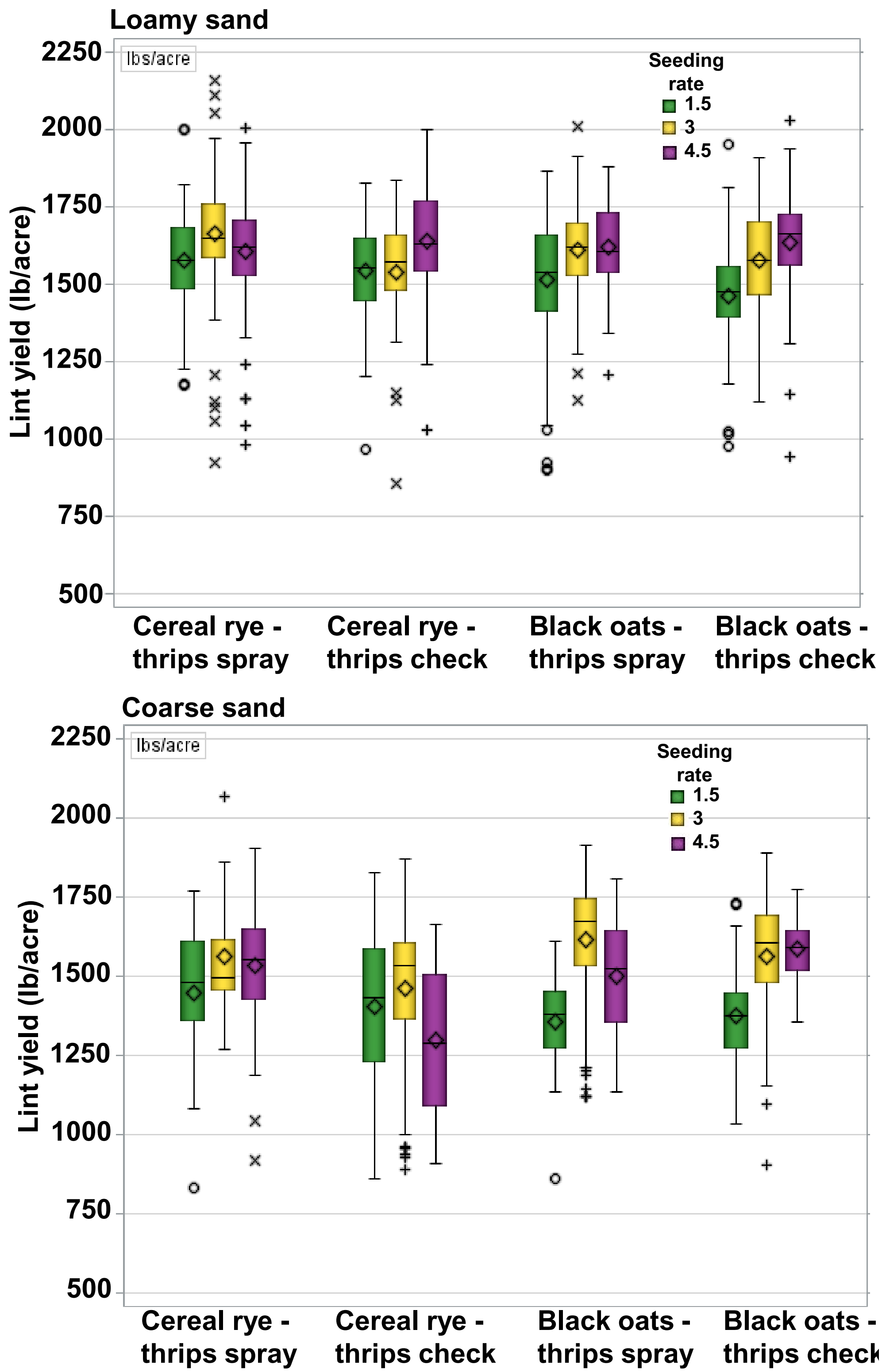

Figure 10. Lint yield associated with loamy sand (above) and coarse sand (below) areas of the cover crop management*seeding rate*insect control trial – 2021, Manila, AR. The bottom and top edges of the box are located at the sample 25th and 75th percentiles. The center horizontal line indicates the 50th percentile (median), and the diamond symbol indicates the mean. Whiskers extend from the box as far as the data extend, to (at most) 1.5 interquartile ranges. Symbols outside whisker are outliers.

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