INFLUENCE OF TILLAGE SYSTEM AND IRRIGATION INITIATION TIMING ON SUSCEPTIBILITY OF THREE COTTON CULTIVARS TO TARNISHED PLANT BUG – YEAR II

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Abstract

Cotton production practices that impact pace of square production in early season and/or prolong availability of squares in late season will affect host finding, feeding, ovipositional preferences, and survival of tarnished plant bugs (*Lygus lineolaris* (Palisot de Beauvois)). Will such factors change the relative level of host plant resistance (HPR) of cotton cultivars? In this second year of research, we repeated two field experiments to evaluate how conservation tillage practices or irrigation initiation timing might affect plant bug abundance and damage in cultivars that have exhibited varying levels of HPR. Field studies were carried out on the Judd Hill Foundation Research Farm near Trumann in NE Arkansas. We compared performance of three early maturing cultivars with relatively high, medium and low HPR levels: Stoneville 5288 B2RF, Deltapine 0912 B2RF and Phytogen 375 WRF, respectively. Each experiment was arranged in a split-split plot design with main plots of either irrigation or tillage and sub-plots of cultivar and crop protection (protection using insecticides compared to untreated). In the tillage trial there were three treatments: 1) conventional, 2) no-till and 3) terminated wheat cover crop with conservation tillage. For the irrigation initiation trial there were three levels of irrigation: 1) early start (second week of squaring - 47 days after planting (DAP)), 2) delayed start (second week of flowering – 70 DAP) and 3) Rainfed. Sub-plot treatments in both trials were 1) protected with insecticides or 2) unprotected. We used the COTMAN monitoring system to document plant development through the season; the system allows measurement of pace of nodal development, fruit retention and it includes of counts of nodes above white flower (NAWF) for users to gauge late season crop maturity. Cool wet weather affected early season plant development in 2014. For both trials, fewer plant bugs were observed in the more resistant Deltapine 0912 and Stoneville 5288 cultivars compared to Phytogen 375 for which infestation levels were above action thresholds earlier in the season and for longer periods of time. Plant bug infestations reduced yield ($P<0.05$) for all cultivars in unprotected subplots in the tillage trial; however, plant bug damage did not result in consistent yield reductions in the irrigation study ($P=0.12$). Irrigation timing affected yield with lower yield in rainfed treatments compared to delayed irrigation initiation; highest yields were observed with early initiation. Neither tillage nor irrigation practices appeared to negatively impact host plant resistance levels among the resistant cultivars in 2014. Expanded understanding of HPR tolerance and resistance mechanisms will enable crop managers to make more efficient use of this important cultural control tactic within the framework of integrated pest management.

Introduction

Plants may avoid damage from insect pests through morphological (e.g. physical features such as trichomes) and chemical defenses (e.g. *chemical* compounds that confer antibiosis such as gossypol) (reviews by Stout 2013; Jenkins 1994). Plants also may possess plant traits or physiological processes that lessen the amount of damage resulting per unit injury – they may tolerate and/or recover from the injury ((Reese et al. 1994; Sadras and Fitt 1997). Plants also may avoid damage via escape in time -- completing key developmental stages during times of low pest abundance. In an integrated pest management (IPM) system, crop managers seek to exploit these resistance, tolerance and avoidance characteristics and processes using cultural control tactics – agronomic practices to reduce pest abundance and damage below that which would have occurred if the practice had not been used. Cultural control tactics in cotton production includes the use of cultivars with host plant resistance (HPR), and adoption of agronomic practices that promote crop earliness.

We conducted two field experiments to examine performance of three early maturing cultivars, Stoneville 5288 B2RF, Deltapine 0912 B2RF and Phytogen 375 WRF, with high, medium and low HPR ratings, respectively. We selected these cultivars based on results from previous field and laboratory evaluations in our on-going HPR research program in Arkansas (Bourland et al 2014; Studebaker and Bourland 2014; Teague et al. 2014). The cultivars were grown in different tillage systems or with different irrigation timing. The tillage plots were first established in fall 2007, and in previous seasons (in studies with just one cultivar), crop delay had been observed with in some years with both cover crop and with the no-till treatment plots compared to conventional tillage practices (Teague et al. 2010; 2012). Delayed maturity also is one negative consequence when pre-flower water deficit stress is followed at first flowers by a late start time of irrigation (Teague et al 2011; 2013). Continued water deficits in non-irrigated cotton in low rainfall seasons ultimately results in premature cutout. Our aim in the 2014 irrigation initiation study was to trigger differences in late season plant maturity by with irrigation timing and compare infestation levels, plant injury and crop damage among the three cotton cultivars.

Materials and Methods

Both experiments were conducted on the Judd Hill Foundation Research Farm near Trumann in northeast Arkansas. The small plot studies were positioned in adjacent field areas on the 35 acre research farm. Soil at the field site is classified as Dundee silt loam.

Tillage System

The experiment was arranged as a 3*3*2 factorial (tillage*cultivar*protection) in a split-split plot design with 3 replications. Tillage treatments were considered main plots and were 1) conventional, 2) no-till, and 3) terminated winter wheat cover crop with conservation tillage. The three cultivars, considered subplots, were either unprotected (untreated check) or protected (sprayed with insecticides).

Fall tillage practices in the conventional and cover crop treatments consisted of using disk bedders to re-form beds after stalks were shredded following the previous season's cotton crop. Wheat was broadcast planted in the cover crop treatment mainplots (10 lb seed/ac) in mid-October. After seeding, a field cultivator (do-all) was used to smooth the tops of beds in the cover crop treatment. In March, a broadcast application of the herbicide glyphosate was made by air across the entire experiment to"burndown" winter weeds in no-till as well as terminate the winter cover crop. In-season production practices were similar across all tillage treatments with the following exceptions used only in conventional tillage treatment: disk bedders were used to re-form beds (May), tops of beds were flattened with a field cultivator prior to planting on 16 May, and row middles (water furrows) cleared with sweep plows on 26 June. No cultivations were made in any treatment. Cruiser treated (thiamethoxam) seeds were planted on 16 May at 3 to 4 seeds/ft. on raised beds spaced at 38 inches. A no-till planter was employed, and planter settings were adjusted for each tillage treatment to ensure uniform seed depth and good soil-seed contact. Sub-plots were 16 rows wide, 55 ft long with 10 ft alleys. Rows 8 through 12 were used for plant and pest monitoring, and rows 5 and 6 were used for final end-of-season plant mapping and yield assessments. The field was furrow irrigated weekly as needed using poly-pipe. Additional timing of practices and pesticide applications rates are sumarized in Table 1.

Table 1. Tillage*HPR trial production details including dates of planting and irrigation, application dates for insecticide, plant growth regulator and harvest aids, and harvest date – 2014, Judd Hill, AR.

Operation	Date	Days after planting
Date of planting	12-May	
Insecticide[1]	8, 15, 25 July	57, 64, 74
Irrigation	23 June, 10, 16, 28 July	42, 59, 65, 77
Mepiquat chloride[2]	7, 22 July	56, 71
Defoliation/boll opener	1, 14 October	142, 155
Harvest	26 October	167

[1]Insecticide applied using tractor-mounted sprayer to protected treatments only: on 57 DAP; 0.75 lb/ac acephate + 9 oz/ac Diamond (novaluron) on 64 DAP; 2 oz/ac Transform 74 DAP.
[2]Mepiquat chloride applied at 8 and 16 oz/acre, on 56 and 71 DAP, respectively.

Plant stand density was determined by counting no. of emerged plants per 3 ft in two transects across 4 rows in two different sections of each sub-plot. Stand counts were made on 3 June (22 days after planting (DAP)). Insect monitoring began at crop emergence with weekly visual inspections. Thrips infestation levels were quantified three weeks after planting using whole plant "thrips washes". Plants were cut at the soil level and immediately placed in sealed plastic bags, placed in coolers with ice packs and taken back to the laboratory. Plants were washed in a 70% alcohol solution in glass beakers. The plant wash solution for each 10 plant sample was poured through coffee filters to separate thrips and other debris from alcohol. Using a dissecting microscope, we counted thrips adults and larvae for each filtered sample.

Crop monitoring with COTMAN (Danforth and O'Leary 2004, Oosterhuis and Bourland 2008) as well as plant bug monitoring using drop cloths were performed each week from first squares through the latest possible cutout date - seasonal cutout (11 August). Scouts inspected two sets of five consecutive plants located on adjacent rows using standard COTMAN Squaremap sampling protocol. By the second week of flowering, scouts also began recording nodes above white flower (NAWF). Ten plants with first position white flowers were selected in the two sample rows weekly, and numbers of main stem squaring nodes determined. Days to cutout (mean NAWF = 5) calculations were derived from standard output using the COTMAN software (http://www.cotman.org/). For tarnished plant bug monitoring, scouts used a drop cloth to sample 2 adjacent rows per plot. Average number of collected nymphs and adults per drop cloth sample was analyzed using PROC GLM (SAS Institute Inc., Cary, NC) separately for each date. Insecticide was applied to appropriate treatment plots using a high clearance, tractor mounted sprayer with 8-row boom. We applied insecticides in the protected treatment when field population densities in any treatment group exceeded the Cooperative Extension Service action threshold of 3 plant bugs/3 ft. of row sampled using drop cloths (two adjacent rows, 1.5 ft on each row=3 ft of row=1 drop cloth sample). End-of-season season plant mapping was performed using the COTMAP procedure (Bourland and Watson 1990). Following defoliation, ten plants within the harvest rows (five consecutive plants from each row) were examined for node number of first (lowest) sympodial branch on the main axis, number of monopodia, and number of bolls on sympodia arising from monopodia. Bolls located on main stem sympodia (1st and 2nd position) were recorded, as well as bolls located on the outer positions on sympodial nodes (>2nd position). The highest sympodium with 2 nodal positions and number of bolls on sympodia located on secondary axillary positions also were noted. Plant height was measured as distance from soil to apex. Yield determinations were made using a 2-row research cotton picker. Seedcotton "grab" samples collected from picker basket) in each treatment plot were ginned with a laboratory gin and sent to the Texas Tech Fiber and Biopolymer Research Institute for HVI evaluations to assess fiber quality.

Irrigation

The irrigation initiation * HPR experiment was arranged in a split-split plot design as 3*3*2 factorial with 3 replications. Main plots were irrigation: 1) Early start (during squaring - 47 DAP), 2) Delayed start (second week of flowering – 70 DAP) and 3) Rainfed. Sub-plot treatments were cultivars and protection as described above for the tillage trial. Watermark sensors installed in top of the bed at 8" depth were used to initiate irrigation (soil water tension exceeded 30 cb) after first squares. Plots were 40ft long, 8 rows wide with 10 ft alleys. Rows 3 and 4 were used for plant and pest monitoring, and rows 5 and 6 were used for final end-of-season plant mapping and yield assessments. Crop monitoring with COTMAN as well as insect monitoring using drop cloths were performed as described above as were harvest operations. Additional information on timing of practices plus rates of pesticide applications are sumarized in Table 2.

Table 2. Irrigation initiation trial dates of planting and irrigation, application dates for insecticide, plant growth regulator and harvest aid, and harvest date for 2014 Irrigation Initiation *HPR – Judd Hill, AR.

Operation	Date	Days after planting
Date of planting	7 May	
Insecticide [1]	8, 15, 25 July	62, 69, 79
Irrigation- Early start treatment	23 June, 10, 16, 28 July	47, 64, 70, 82
Irrigation- Late start treatment	16, 28 July	70, 82
Mepiquat chloride[3]	7 , 22 July	61, 76
Defoliation/Boll Opener	1, 14 October	147, 160
Harvest	26 Oct	172

[1]Insecticide applied using tractor-mounted sprayer to protected treatments only: on 57 DAP; 0.75 lb/ac acephate + 9 oz/ac Diamond (novaluron) on 64 DAP; 2 oz/ac Transform 74 DAP.

[2]Mepiquat chloride applied at 8 and 16 oz/acre, on 61 and 76 DAP, respectively.

Results

Cool and rainy weather conditions characterized early season with temperatures dipping in the high 40's (°F) three consecutive nights and daytime temperatures not exceeding 60 °F in the first 10 DAP. Monthly rainfall is shown in relation to previous seasons in Table 3. Planting was delayed in the tillage trial due to spring showers. The chilling temperatures and wet conditions affected early season germination and seedling plant development in both trials.

Tillage

Cool weather immediately after planting impacted seedling establishment. The resulting plant stand among all treatments was lower than our target range of 8 to 9 plants/3 row ft. across all plots. Stand densities at 22 DAP, ranged from 5.0 to plants per 3 ft. for the DP 0912 in no-till system compared to 7.2 plants per 3 ft. for PHY 375, also in no-till. There were slightly fewer plants in conventional compared to cover crop and no-till treatments in 2014 although not statistically significant (P=0.20). Plant stand density differed among cultivars (P=003); fewest plants typically were associated with DP 0912 compared to other cultivars (Figure 1). There were no significant cultivar * tillage interactions (P=0.34).

No differences in numbers of thrips were observed among tillage treatments; however, there were greater numbers of thrips associated with DP 0912 compared to the other cultivars (P=0.05) (Figure 2). There were no significant interactions. Thrips numbers generally were below threshold with very low levels of injury. Tobacco thrips was the dominant species in 2014.

COTMAN growth curves for the 2014 tillage trials show that main stem nodal development in the no-till treatment was delayed season-long (Figure 3). Cool, wet conditions during stand establishment affected seedling vigor and stand, particularly in the tillage trial for no-till. Crop maturity delay in all treatments was related to growing conditions and fruit retention. Lower retention was associated with either square shed resulting from plant bug feeding (highest sheds from plant bugs were in unprotected treatment plots) or small boll shed related to undetermined physiological stress factors. Plant response to pre-flower square shed from bugs typically will not be reflected in COTMAN growth curves until *after* flowers. A flatter slope during flowering indicates continued nodal production in the terminal; this typically indicates a lack of boll loading stress due to reduced sink strength.

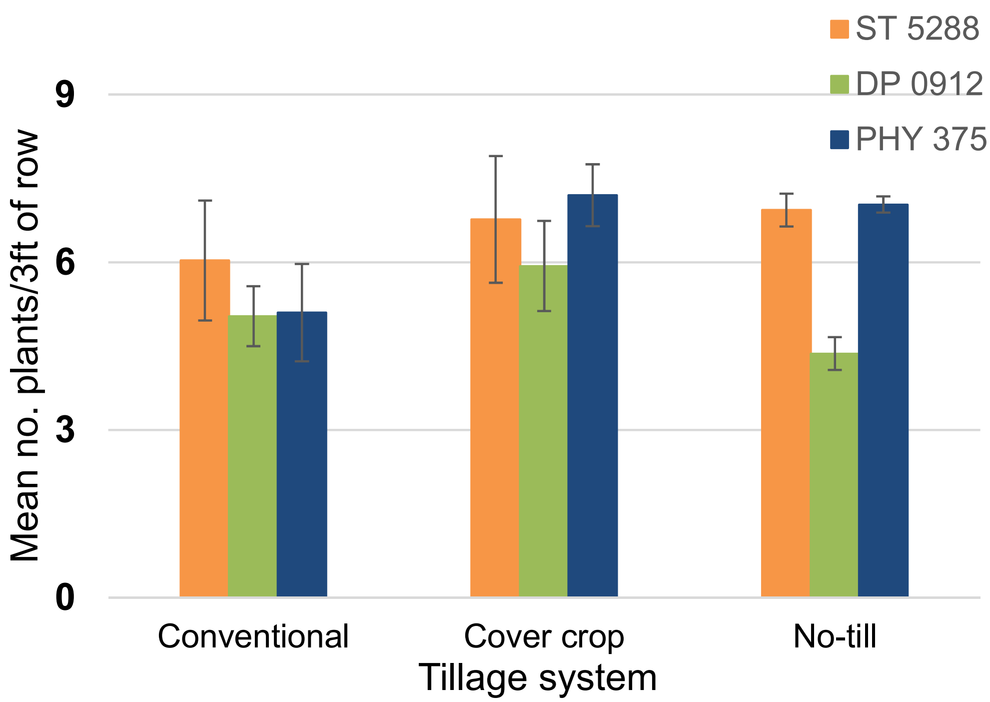

Figure 1. Mean (±SEM) no. plants per 3 ft. over three dates for conventional, wheat cover crop and no-till main plot treatments in 2014 tillage*HPR trial - Judd Hill, AR..

Infestation levels of plant bugs were moderately high for the NE Arkansas region in the 2014 production year. Plants that were not protected from plant bug feeding had higher levels of pre-flower square shed (data not shown). Square retention at the 1st position on mainstem squaring nodes was reduced to < 85% in most treatments by 60 DAP triggering insecticide application in protected treatments. Pre-flower square shed exceeded 15% by first flowers. Maturity delay indicated by growth curves after flower (NAWF) in the tillage trial likely was related to both insect as well as non-insect related shed of fruiting forms. Plant bug population densities exceeded action threshold in all cultivars by the second week of flower (Figure 4). Mean plant bug numbers were slightly higher with cover crop at 70 DAP, but these levels were not statistically significant. Plant bug numbers in protected treatment plots were reduced to sub-threshold levels following insecticide applications. Boll retention differences among treatments is reflected in results from COTMAP end-of-season measurements of early boll retention (Figure 5); lowest retention was observed in the susceptible Phytogen 375 compared to the more resistant lines. Protection with insecticides also increased early boll retention, but there were no differences among tillage treatments.

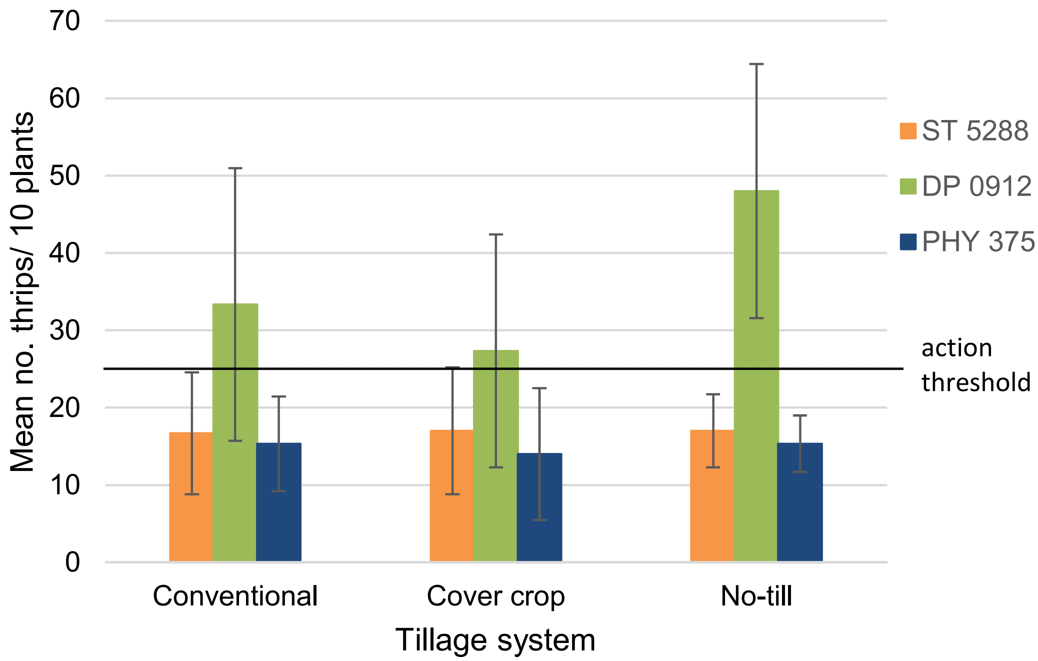

Figure 2. Mean (±SEM) no. thrips per 10 plants observed in seedlings of three cotton cultivars collected 22 days after planting in the Judd Hill tillage*HPR trial - 2014.

The days to cutout calcultaions from NAWF sampling reflect maturity delay among all treatments (Table 4) with no treatments reaching physiological cutout by the target of 80 DAP. There were significant differences among tillage system on mean no. days to cutout (P=0.03) as well as with cultivar (P=0.01) and protection (P=0.03), but there were no significant interactions. The latest maturity was noted with unprotected Phytogen 375 grown in the no-till system. Overall, the DP 0912 reached cutout earlier than the other cultivars. Cutout was delayed in the no-till system, and protected cotton was ca. 3 days earlier than unprotected plants.

Table 3. Monthly precipitation totals from the Judd Hill Research Station for the crop production seasons 2008 through 2014.

	Rain (inches)						
Month	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**
April	6.9	9.5	3.7	7.9	1.5	5.9	5.9
May	4.0	9.8	7.1	8.8	0.0	11.6	4.7
June	1.4	4.6	0.6	1.8	0.0	3.2	7.3
July	1.8	8.3	7.0	0.8	1.2	3.5	1.8
August	0.6	3.8	0.3	3.5	1.6	6.4	1.1
September	3.2	4.8	0.8	1.5	5.2	2.6	0.4
October	2.9	12.4	0.4	2.3	3.4	3.6	0.2
Total	20.8	53.2	19.9	26.6	12.9	36.7	21.3

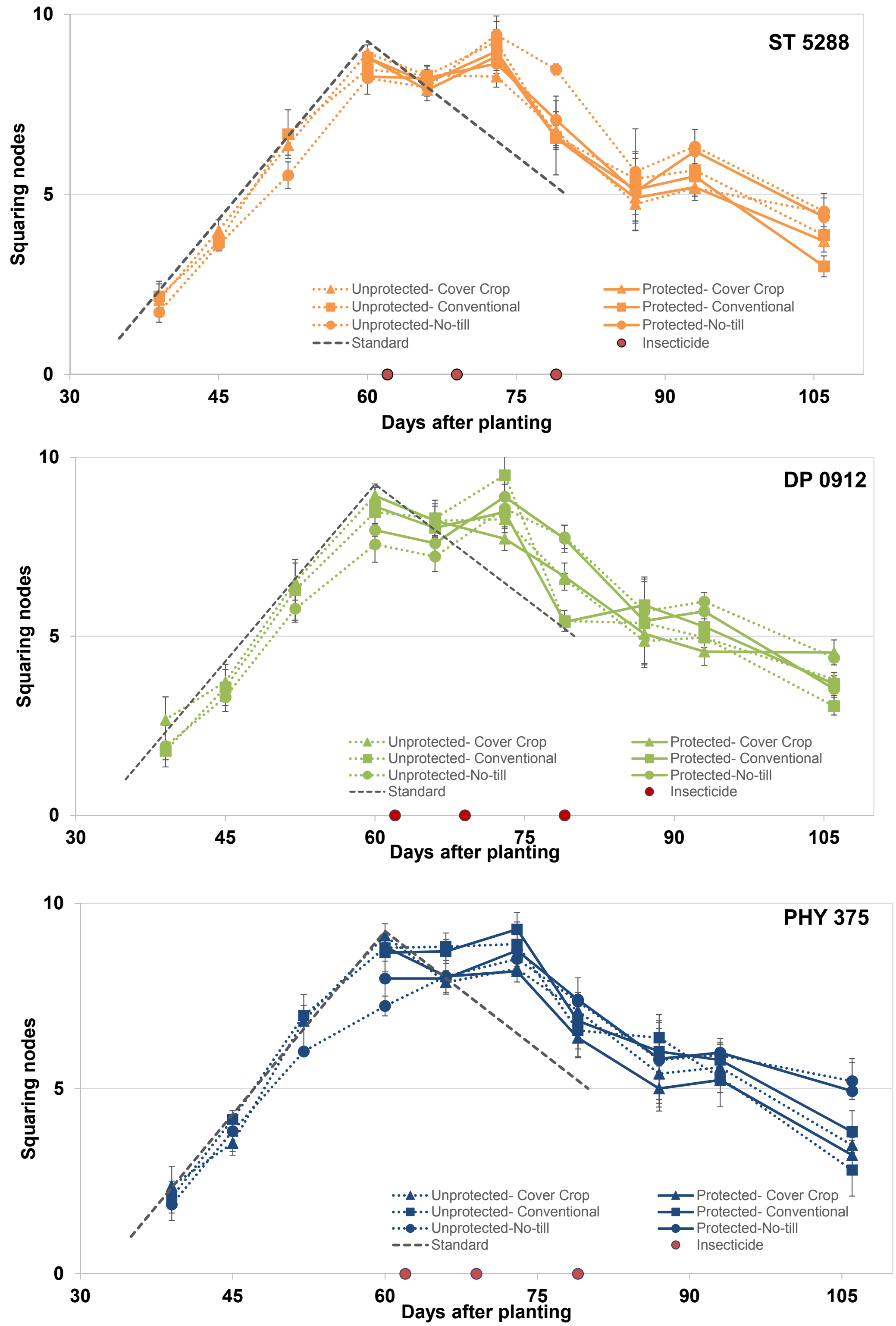

Figure 3. COTMAN growth curves for tillage*HPR trial for three cultivars, protected or unprotected from infestations of tarnished plant bug - 2014 Judd Hill, AR.

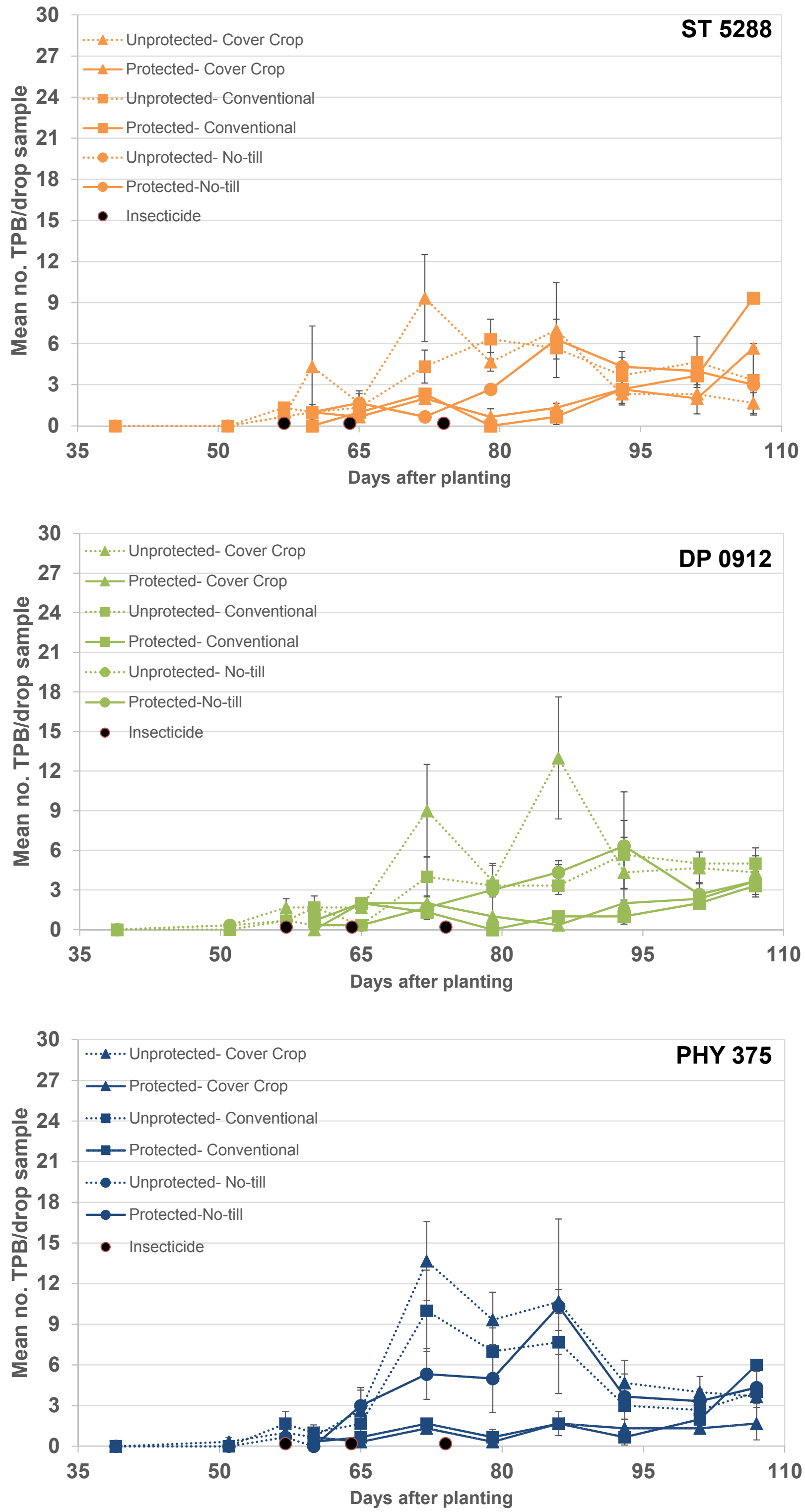

Figure 4. Mean no tarnished plant bugs per drop cloth sample (3 ft. of row) with three cultivars either protected with insecticide sprays or unprotected in 2014 tillage trial – Judd Hill, AR.

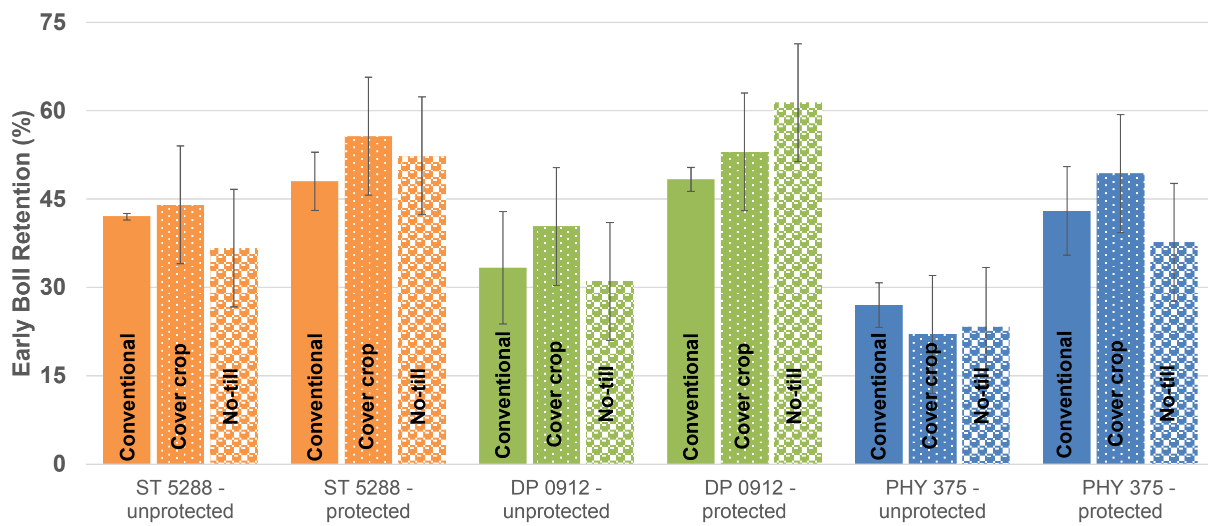

Figure 5. Mean (±SEM) % early boll retention (retention of first position bolls on lowest five main stem sympodia) was significantly reduced in unprotected subplots (P<0.001) and among cultivars (P<0.001), but there were not significant differences among tillage systems nor were there significant interactions.

Tillage, cultivar and protective insecticidal sprays significantly impacted yield in 2014 (Figure 6). Lower yields were associated with the no-till system (P=0.05) compared to conventional and wheat cover crop systems. In the seven years of the tillage study, yields in the no-till generally have been lower compared to the cover crop and conventional treatments. Factors reducing no-till yield appear not to have been insect-related. Yields were lowest for the cultivar Phytogen 375 compared to Stoneville 5288 and Deltapine 0912 (P<0.001). Significantly lower yields were observed in unprotected subplots compared to subplots protected using insecticide (P=0.001). There were no significant interactions (P>0.25).

Table 4. Tillage system*HPR trial plant maturity measurements - days from planting to physiological cutout (NAWF=5) for the three cultivars either protected or unprotected with insecticides during the first four weeks of flowering – Judd Hill, AR, 2014

Tillage treatment	Protected			Unprotected		
	ST 5288	DP 0912	PHY 375	ST 5288	DP 0912	PHY 375
Conventional	96	96	94	98	93	99
Cover Crop	95	90	95	98	93	97
No-till	101	98	104	101	102	106

Tillage main effects (P=0.05) and cultivar subplot effects (P=0.01) were significant; however, insecticide protection (P=0.13) did not significantly affect days to cutout in 2014. There were no significant cultivar*protection (P=0.83), cultivar*tillage (P=0.85) or cultivar*tillage*protection (P=0.11) interactions.

Irrigation

Our protocol for irrigation timing in the early start treatment was to initiate irrigation after the plants began squaring when there was one week without rain and Watermark sensors registered soil water levels <30cb. Weekly irrigation applications thereafter were made if there was low (<0.3 inches) rainfall. Early start mainplots received irrigation at 47 and 64 DAP. Both early and delayed treatments were irrigated 70 and 82 DAP. First flowers were observed at 66 DAP.

COTMAN growth curves for the 2014 irrigation trial show that main stem nodal development was delayed season-long in relation to the standard curve (Figure 7). Crop maturity delay in all treatments was related to growing conditions pre-flower and fruit retention during effective flowering. Lower retention was associated with either square shed resulting from plant bug feeding (highest sheds from bugs were in unprotected treatment plots) or small boll shed related to undetermined physiological stress factors. Rain events undermined our efforts to manipulate plants to produce wide ranges in late season maturity among irrigated treatments; however, rainfed plants did reach cutout earlier than irrigated plants (Table 5). After first flowers, COTMAN growth curves for irrigated treatments did not follow the target development curves; instead of a smooth decent toward cutout, slope of curves flattened, indicating continued nodal development and delayed cutout indicative of time-dependent compensatory growth.

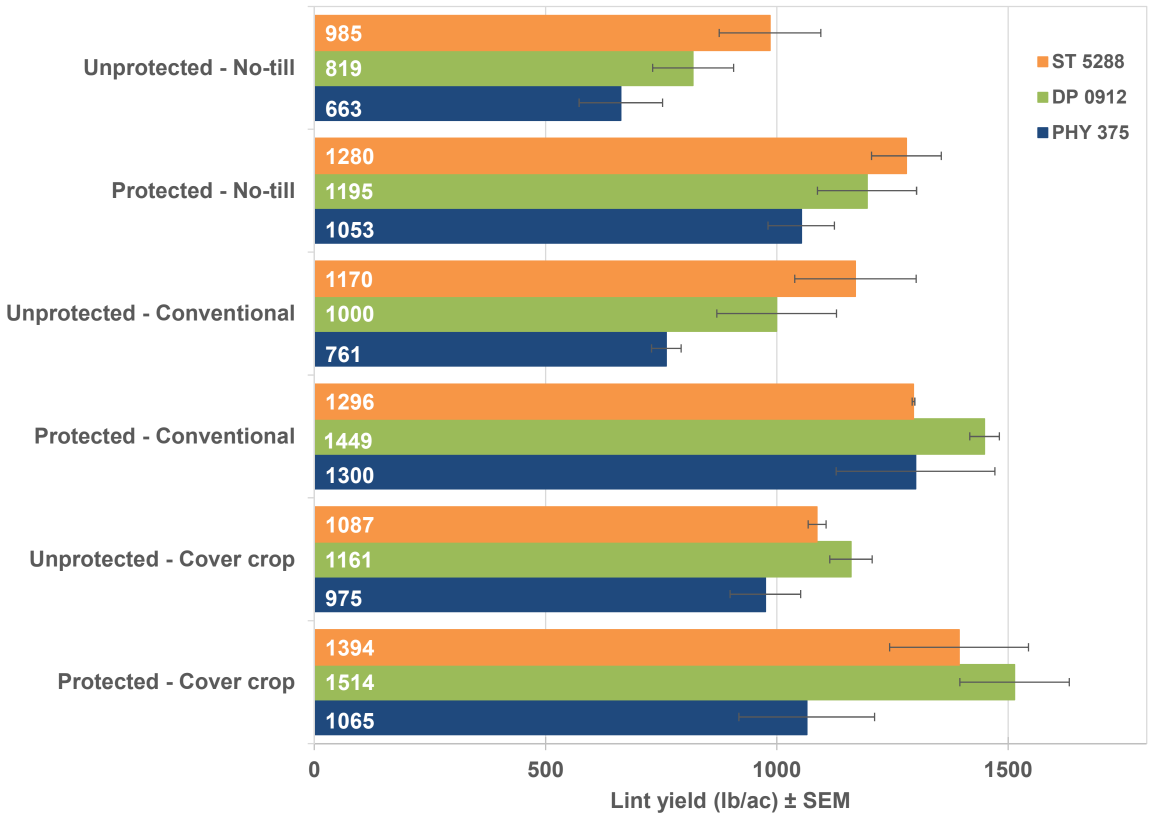

Figure 6. Mean (±SEM) lint yield (lbs/ac) in 2014 tillage*HPR trial at Judd Hill, AR.

Table 5. Irrigation initiation*HPR trial plant maturity measurements - days from planting to physiological cutout (NAWF=5) for the three cultivars with either early or delayed irrigation initiation timing and protected or unprotected with insecticides during the first four weeks of flowering – Judd Hill, AR, 2014.

Irrigation Initiation Treatment[1]	Protected			Unprotected		
	ST 5288	DP 0912	PHY 375	ST 5288	DP 0912	PHY 375
Early Start	99	94	95	100	98	93
Delayed Start	94	93	94	96	90	93
Rainfed	89	87	87	85	85	85

[1]Significant main effects of irrigation initiation on plant maturity were observed in 2014 (P=0.01); there also were significant differences in days to cutout associated with cultivar (P=0.01) but not protection (P=0.5). There were no significant interactions

The irrigation trial, with its earlier planting and subsequent earlier availability of squares had greater early season pest pressure compared to the tillage study. (This was unusual because the area of the field with the tillage experiment lies adjacent to a large pasture area, and plant bugs typically are observed move from weedy host plants into that portion of the research farm first during a typical season. Generally, planting dates similar among the experimental areas of the research farm). Plant bug numbers exceeded threshold level one week earlier in the susceptible Phytogen 375 compared to the other cultivars. Plant bug infestation levels across all cultivars exceeded threshold during flowering if plants were not protected with insecticides. Plant bug abundance was not impacted by irrigation timing effects (Figure 8), but there were differences among cultivars. As was observed in the tillage trial, bug infestation level were

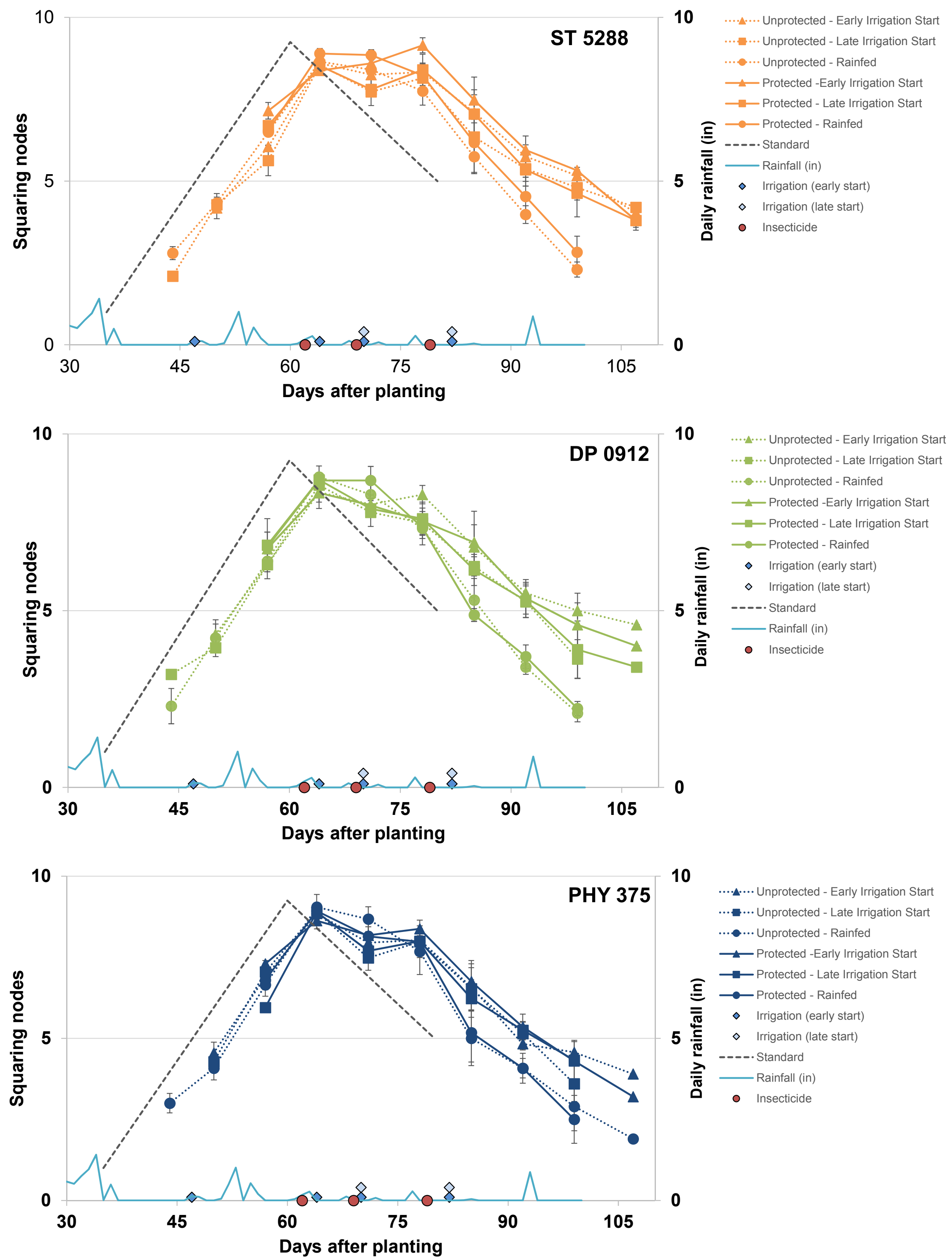

Figure 7. COTMAN growth curves for 2014 irrigation initiation*HPR trial with three cultivars, protected or unprotected from infestations of tarnished plant bug; rainfall, irrigation and insecticide application timing are also shown -- Judd Hill, AR.

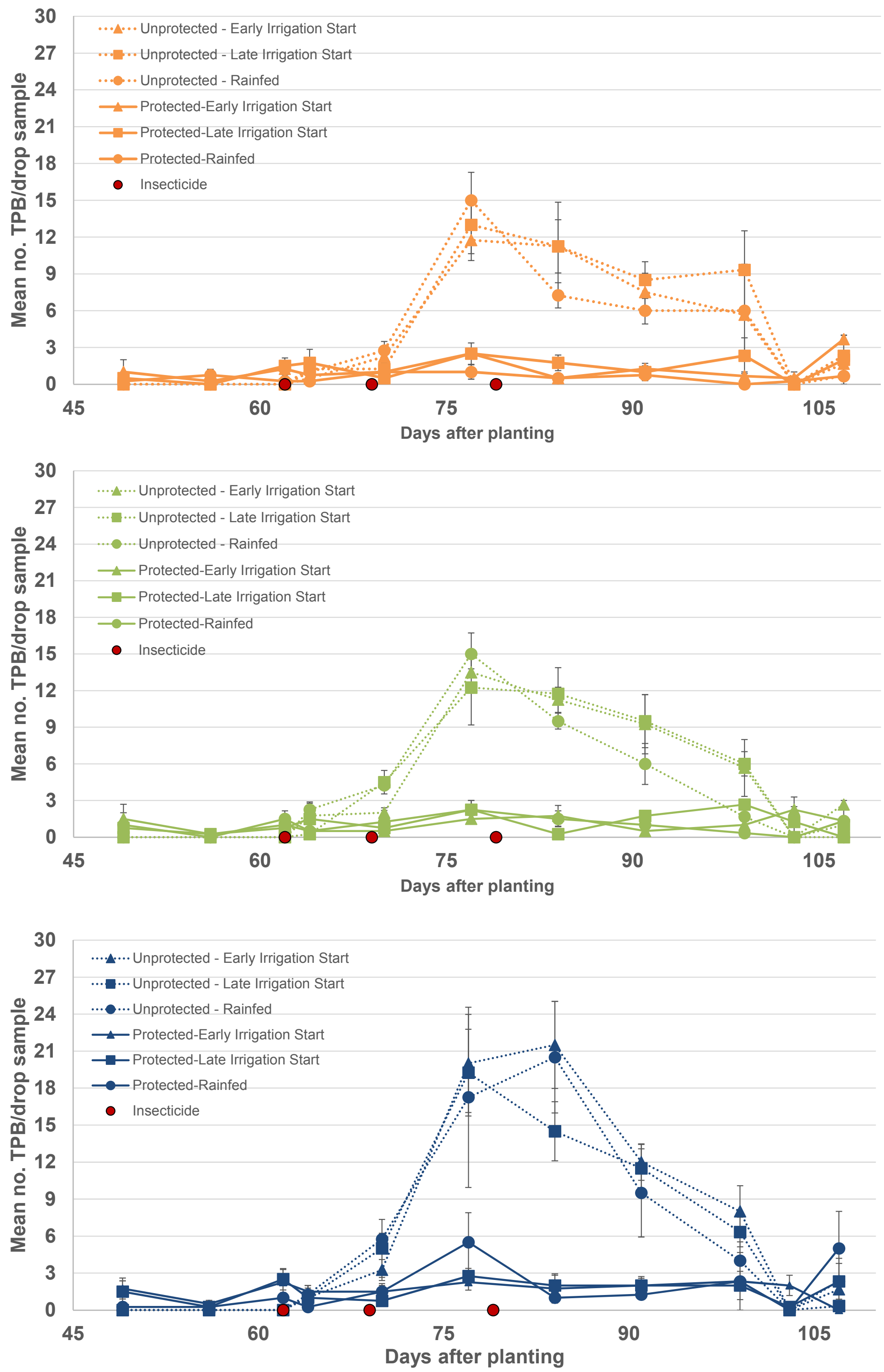

Figure 8. Mean no tarnished plant bugs per drop cloth sample (3 ft of row) in 2014 irrigation initiation*HPR trial with three cultivars either protected with insecticide sprays or unprotected– Judd Hill, AR.

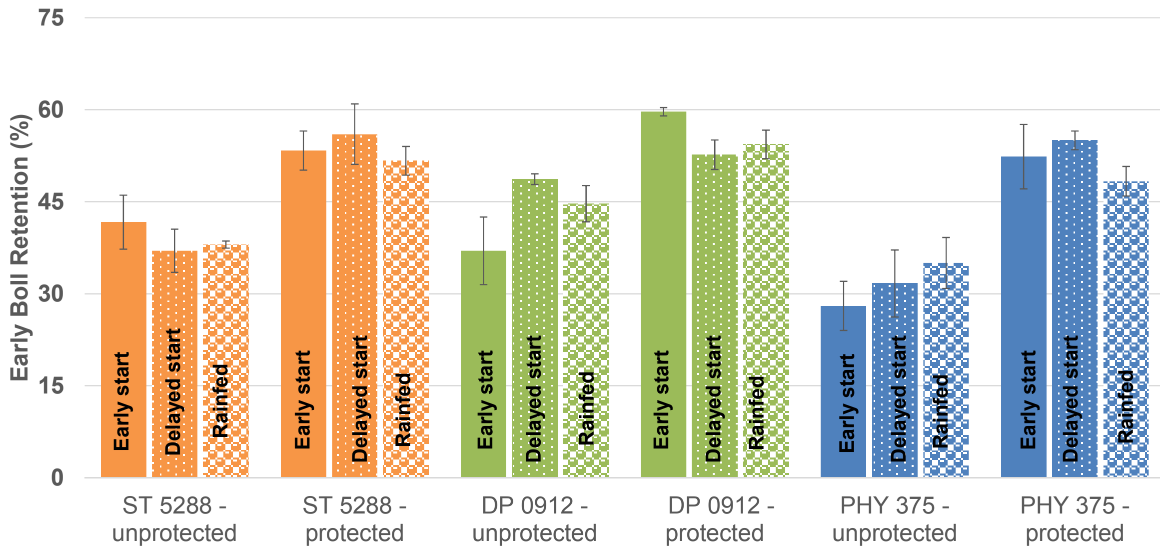

Figure 9. Mean (±SEM) % early boll retention (retention of first position bolls on lowest five main stem sympodia) was significantly reduced in unprotected subplots (P<0.0001) and among cultivars (P<0.01), but there were not significant differences among irrigation main effects nor were there significant interactions – Judd Hill, AR.

highest in the Phytogen 375. Square shed levels were similar among irrigation treatments through first flowers, and then were highest in unprotected plants in the susceptible Phytogen 375 (data not shown).. Significant differences in shed levels were associated with insecticide spray and cultivar subplot effects (P<0.05), but not irrigation main plots. There were no significant interactions. These retention differences were reflected in the end-of-season COTMAP observations with early boll retention measurments (Figure 9) with differences among protection and cultivar subplot treatments but not irrigation main plots.

Irrigation and irrigation timing significantly (P=0.01) influenced lint yield in 2014 (Figure 10). Early start irrigation produced higher yields than delayed start. Lowest mean yields were observed in rainfed treatments. Insecticide protection (P=0.12) and cultivar (P=0.24) did not affect yield, and there were no significant interactions. There was much variability among plots in 2014. It is likely that chilling stress in early season and cloudy conditions during effective flowering as well as plant bug infestations all contributed to lack of uniformity. Even with the plant bug infestations, highest mean yield among cultivars was in unprotected, early irrigated DP 0912.

Fiber quality assessments for the experiments were not completed in time for this report.

Conclusions

Identifying and untangling trends among treatment effects in these 2014 trials was problematic because of confounding effects of chilling temperatures and poor growing conditions during the pre-squaring period. Even so, variation in relative HPR levels among cultivars appeared to remain consistent regardless of tillage or irrigation treatment in 2014. Greatest variation in yield in the tillage trial was observed with the susceptible cultivar, Phytogen 375. Overall, irrigation effects had a dominant impact on earliness and yield with insecticides and cultivar less important.

In-season plant monitoring using COTMAN provided an efficient and systematic sampling methodology to document plant response to treatment effects. These included measures of pace of nodal development, fruit retention and NAWF measures to gauge crop maturity quantified as days from planting to physiological cutout (NAWF=5). Each of these in-season measurements offer important clues for quantifying cotton HPR to tarnished plant bug. Drop cloths were effective for surveying abundance of plant bug nymphs, but COTMAN measures of square shed in pre-flower cotton allowed us to gauge feeding injury from illusive adult bugs. COTMAN sampling provided a rapid means for post-flower assessments of small boll shed, useful in documenting non-insect induced fruit loss. End-of-season mapping with COTMAP was instructive for documenting boll retention; however, timing and cause of sheds can only be determined with in-season monitoring.

Expanded understanding of how production practices affect HPR resistance and tolerance mechanisms will enable crop managers to make more efficient use of this important cultural control tactic. For example, the importance of irrigation management on tolerance and compensation capacity of Midsouth cotton to plant bugs has been examined (Teague 2011; Teague and Danforth 2010, Teague and Shumway 2013; Teague et al. 2010, 2012), but potential interactions of these relationships among cultivars is not well understood. The resistance mechanisms (or lack of) among the three cultivars tested in the present trial are unknown except for morhpological differences associated with relative leaf "hariness" in the Stoneville 5288 compared to the other lines. Trichomes (leaf hairs) perform two crucial autecological functions -- providing defense against herbivores and insulation against the environment. Future plans for this work includes evaluating interactions of growing environment and these poorly understood HPR mechanisms. We will need such knowledge for decision-making as new seed technology becomes available and as planter technology allows selective use of multiple cultivars within variable production fields.

When crop managers expand use of cultural controls, including appropriate cultivar selection and use of production practices that promote early vigor and early maturity, they enhance overall cotton IPM. An integrated approach will allow producers to reduce reliance on costly chemical control and improve cotton sustainability in the USA.

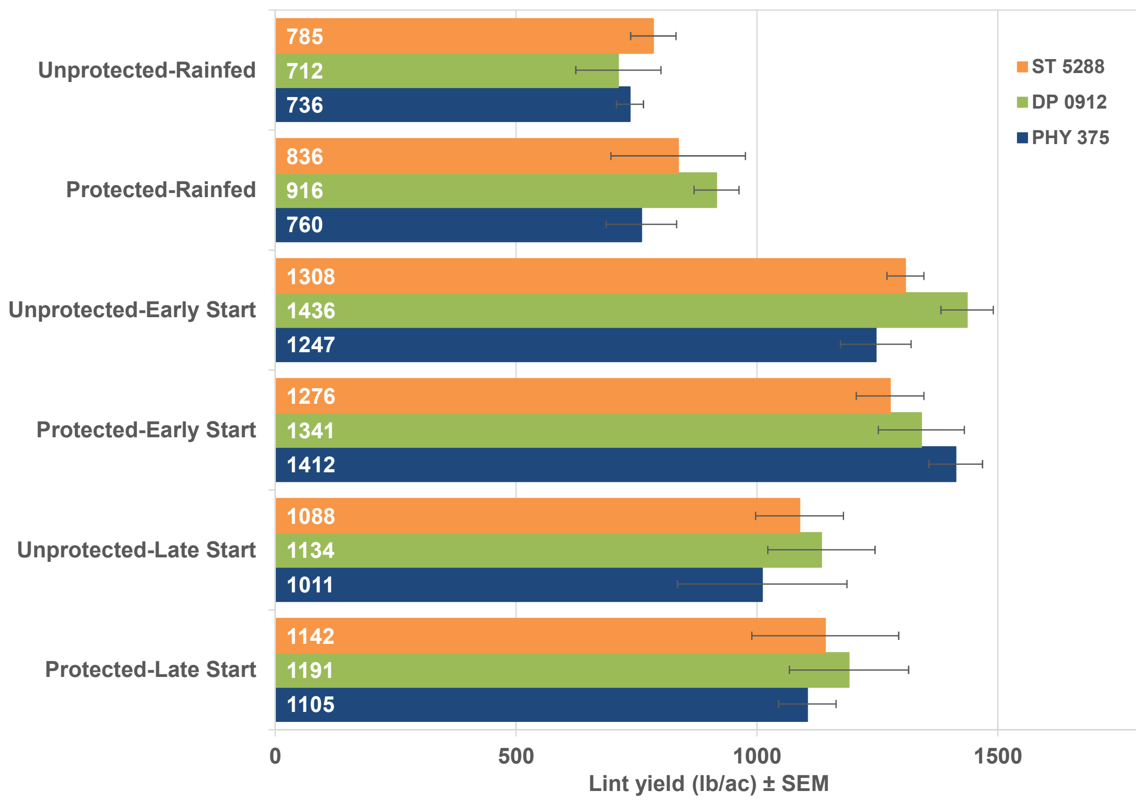

Figure 10. Mean (±SEM) lint yield for 2014 irrigation initiation*HPR trial for three cultivars, protected or unprotected from infestations of tarnished plant bug; - Judd Hill, AR. Irrigation main effects were significant.

Acknowledgements

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