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Societies

Utilizing ThryvOn cotton technology under high thrips pressure

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Left: Tobacco thrips (A) and western flower thrips (B) (Photo courtesy of Huseeth et al., 2019). Right: Young cotton with and without thrips protection in the early season. Photo by Joshua Lee.



Thrips are a common early-season insect pest that Southeast cotton producers must be prepared to combat each season. This article examines how ThryvOn cotton technology performs under high thrips pressure, comparing plant injury, pest

populations, and yield responses with and without insecticide treatments.

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Thrips are a common early-season insect pest that Southeast cotton producers must be prepared to combat each season. Since cotton is known to have low seedling vigor, thrips management must be timely. Tobacco thrips (*Frankliniella fusca*) and western flower thrips (*Frankliniella occidentalis*) are two of the most common thrips species that infest Southeast cotton yearly. Thrips injure young leaves and plant terminals by using piercing-sucking mouthparts to feed. Injury symptomology includes deformed leaves, silvery undersides of cotyledon leaves, leaf crinkling, and injury to developing plant terminals.

Yield responses to thrips are not always consistent. Research has shown that yield reductions may or may not be observed in response to thrips feeding when compared with treatments receiving insecticidal thrips control. Crop maturity can be delayed due to heavy thrips pressure in the early season. Thrips injury delays growth and development by reducing leaf area, requiring the crop to compensate for the loss of photosynthetic tissue by exhibiting more rapid regrowth following injury than in the absence of prior injury. The proposed mechanisms for crop compensation are changes to carbohydrate partitioning in new leaves and other vegetative growth and a possible increase in photosynthetic rates in the new leaves to make up for injured leaves.

Planting date also plays a pivotal role in the management of thrips. In Georgia and Alabama, cotton planting dates range from the beginning of April through June. Cotton planted in April can be more susceptible to thrips injury due to cooler conditions that may occur during the early part of the growing season. If cotton emerges and temperatures turn cool, plant growth and development can slow dramatically. Decreased early-season plant growth can amplify plant injury due to thrips feeding. If growers are planting into suboptimal conditions, precautionary measures must be taken to avoid potential plant injury.

Thrips management considerations

Thrips infestation predictor for cotton

The [Thrips Infestation Predictor for Cotton tool](#) is a predictor model that takes into account weather data to make predictions on the timing of when thrips would arrive, estimated growth stage of cotton, and injury risk based on environmental conditions and thrips pressure.

Chemical management

There are multiple chemical management options for the control of thrips, including insecticide seed treatments, foliar insecticides, and in-furrow insecticides.

Neonicotinoid seed treatments like imidacloprid or thiamethoxam are commonly used for thrips protection in the early season. Foliar insecticide such as acephate are commonly used for protection against thrips in the early season; however, research has documented tobacco thrips with resistance to acephate in some states in the Cotton Belt. In-furrow insecticide applications for thrips management have been used for many years. Aldicarb has been commonly used for the management of thrips and nematodes in the lower Southeast. Aldicarb applied in-furrow significantly reduces thrips numbers in developing cotton. Studies have documented that plants treated with aldicarb also accumulate more dry matter in the early season compared with plants not receiving aldicarb.

ThryvOn

The latest tool for the management of thrips is the introduction of ThryvOn technology (Bayer Crop Science), which is a Bt trait that may reduce the need for insecticide applications for thrips. ThryvOn (Cry 51Aa2) is a Bt trait marketed for the management of thrips and tarnished plant bugs that was first commercially available in 2023.

ThryvOn works by reducing the number of eggs laid in ThryvOn cotton. ThryvOn cotton also has an antifeeding effect. In some cases, growers may see thrips present on ThryvOn cotton but no visible plant injury. This highlights why ThryvOn needs to be scouted under different thresholds than non-ThryvOn.

Project details

This project investigated thrips prevalence, plant injury, and lint yield in response to cultivar (with or without ThryvOn) and insecticide treatment under high thrips pressure.

A field trial was implemented in Tifton, GA to evaluate thrips prevalence, plant injury, crop development, and lint yield in response to cultivar (with or without ThryvOn) and insecticide treatment under high thrips pressure. Treatments consisted of two cotton cultivars and two insecticide treatments. The two cotton cultivars used in the study were DP 2211 B3TXF (ThryvOn) and DP 2012 B3XF (non-ThryvOn). Seeds of both ThryvOn and non-ThryvOn were chemically treated with Imidacloprid from Bayer Crop Science. Therefore, the untreated plots did contain a seed treatment for thrips management, just no in-furrow insecticide. The two in-furrow insecticide treatments were treated and untreated. Insecticide-treated plots received 5 lb/ac of aldicarb (AgLogic 5GG) in-furrow at planting. Untreated plots received no aldicarb in-furrow. Planting dates for each year were based on sufficient accumulation of growing degree days within the first five days after planting to achieve uniform plant emergence while also exposing the crop to high thrips pressure. Specifically, the thrips infestation model predictor was utilized to plant when predicted risk of thrips injury was highest while also having sufficient heat unit accumulation for stand establishment. Cotton was planted on April 18 and April 17 in 2023 and 2024, respectively.

Thrips data collection

Total thrips (per five plants) sampling occurred at 14, 21, and 28 days after planting (DAP). Total thrips were determined by physically removing five individual plants from each plot. Total thrips represent the sum of adult and immature thrips on a given sample date. Plant injury ratings were collected at 21 and 28 DAP during the 2023 and 2024 seasons. These were overall visual ratings of thrips injury per plot and were assigned a numerical value based on the level of plant injury present (Figure 1). Specifically, a 0 plant injury rating represented no visual thrips injury while a plant injury rating of 5 represented severe thrips injured plants and severely damaged plant terminals.

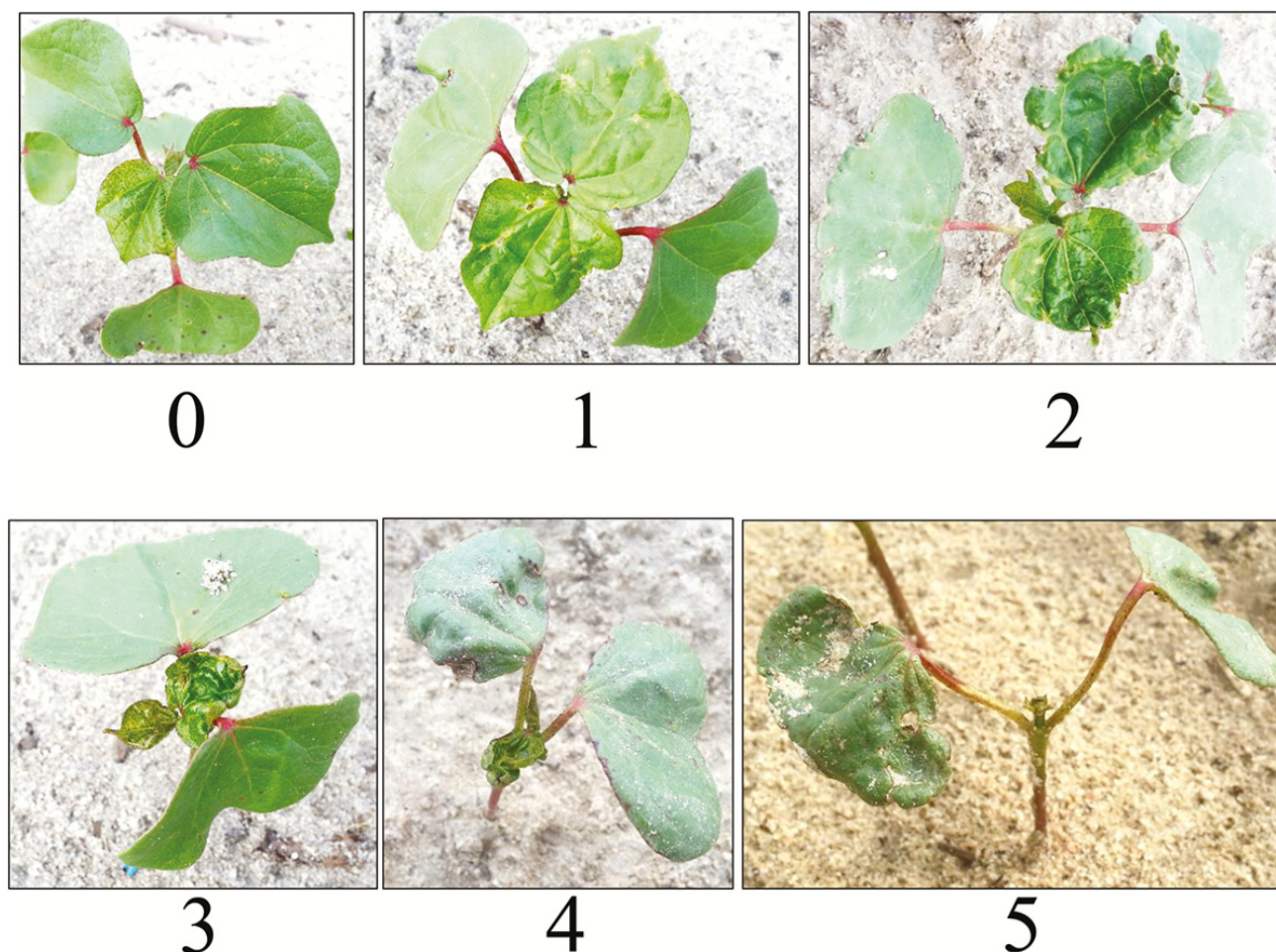


Figure 1. *Thrips injury rating scale (Kerns et al., 2019).*

Results

The 2023 season had higher thrips pressure than 2024. In 2023, shortly after emergence, weather conditions turned cool and slowed plant growth. Due to slowed growth, thrips were able to feed on plants for a longer period and symptoms were more prevalent.

At 21 DAP, a significant interaction between cultivar and insecticide was observed for plant injury in 2023 (Figure 2-A). Plant injury rating was significantly higher in non-ThryvOn untreated (4.0) compared with non-ThryvOn treated (1.9). Although plant

injury ratings were higher for non-ThryvOn than ThryvOn, irrespective of treatment, plant injury rating was significantly higher in ThryvOn untreated (1.3) than ThryvOn treated (1.0).

There was also a significant interaction between cultivar and insecticide treatment for total thrips in 2023 (Figure 2-C). Non-ThryvOn untreated had a significantly higher total thrips density of 50 thrips per five plants compared with six thrips for non-ThryvOn treated. However, ThryvOn showed no difference in total thrips density between treated and untreated plants, averaging four thrips.

There was a significant interaction between cultivar and insecticide for plant injury rating in 2024 at 21 DAP (Figure 2-B). Non-ThryvOn untreated had a significantly higher plant injury rating of 3.2 compared with 1.8 in non-ThryvOn treated. In contrast, plant injury rating was unaffected by insecticide treatment for ThryvOn during the 2024 season and averaged a plant injury rating of 1.2 for both treatments.

Total thrips density at 21 DAP was significantly affected by cultivar in 2024 (Figure 2-D); however, no interactions with insecticide treatment were observed. Total thrips was significantly higher in non-ThryvOn (nine thrips) compared with ThryvOn (three thrips).

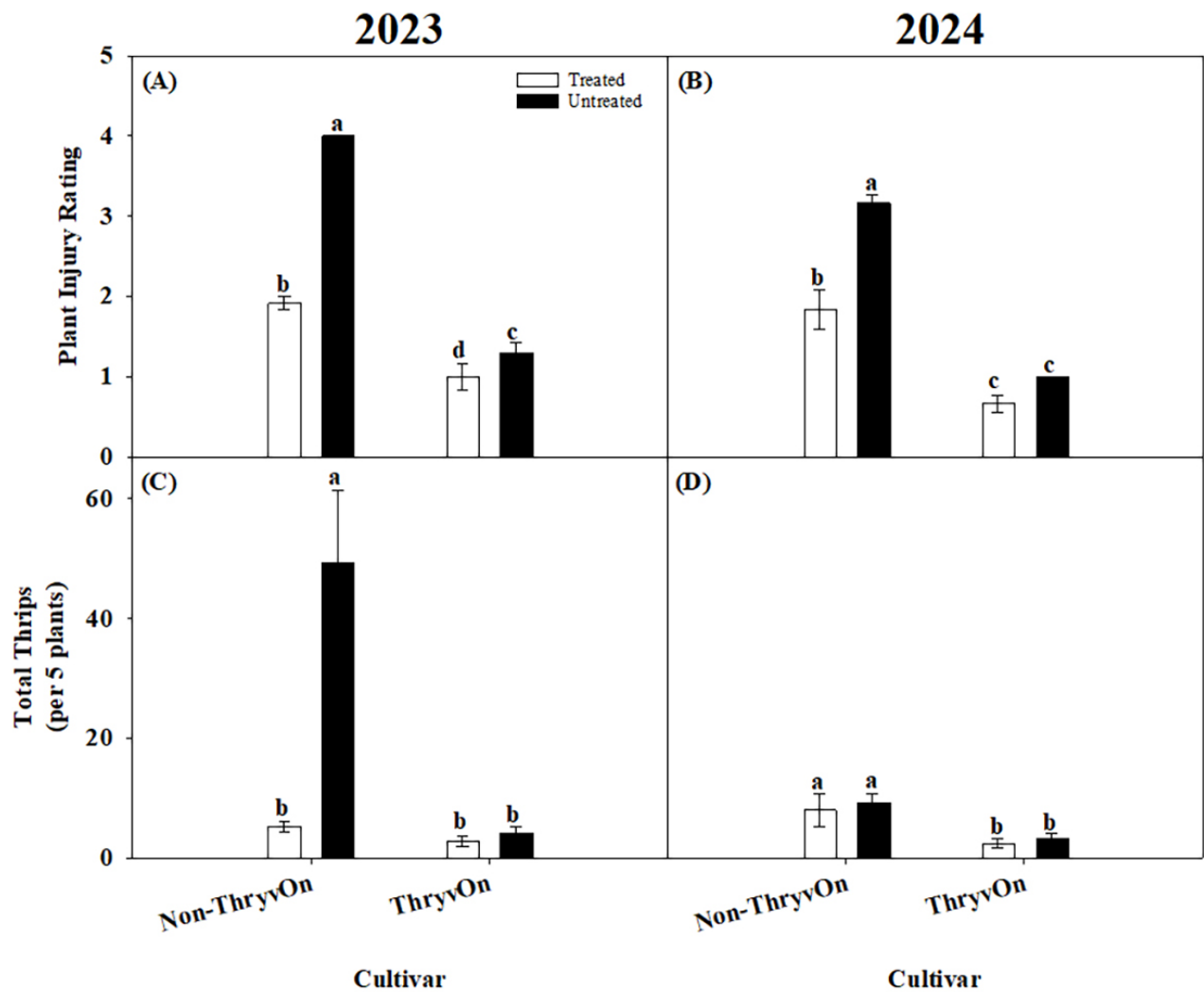


Figure 2. Effects of cultivar and insecticide on plant injury rating (A and B) and total thrips (per five plants) (C and D) at 21 days after planting (DAP) in the 2023 and 2024 growing seasons for a field site in Tifton, GA. White bars represent insecticide treated while black bars represent untreated. Bars represent means $\pm$ standard error ($n = 6$). In all graphs except D, bars not sharing a common letter are considered significantly different ($P < 0.05$). In graph D, different letters indicate cultivar differences only.

There were no significant effects of cultivar, insecticide, or interactions between the two factors for lint yield in the 2023 or 2024 growing seasons (Figure 3). Lint yield

values averaged across all treatments were 1,451 lb/ac in 2023 and 1,274 lb/ac in 2024.

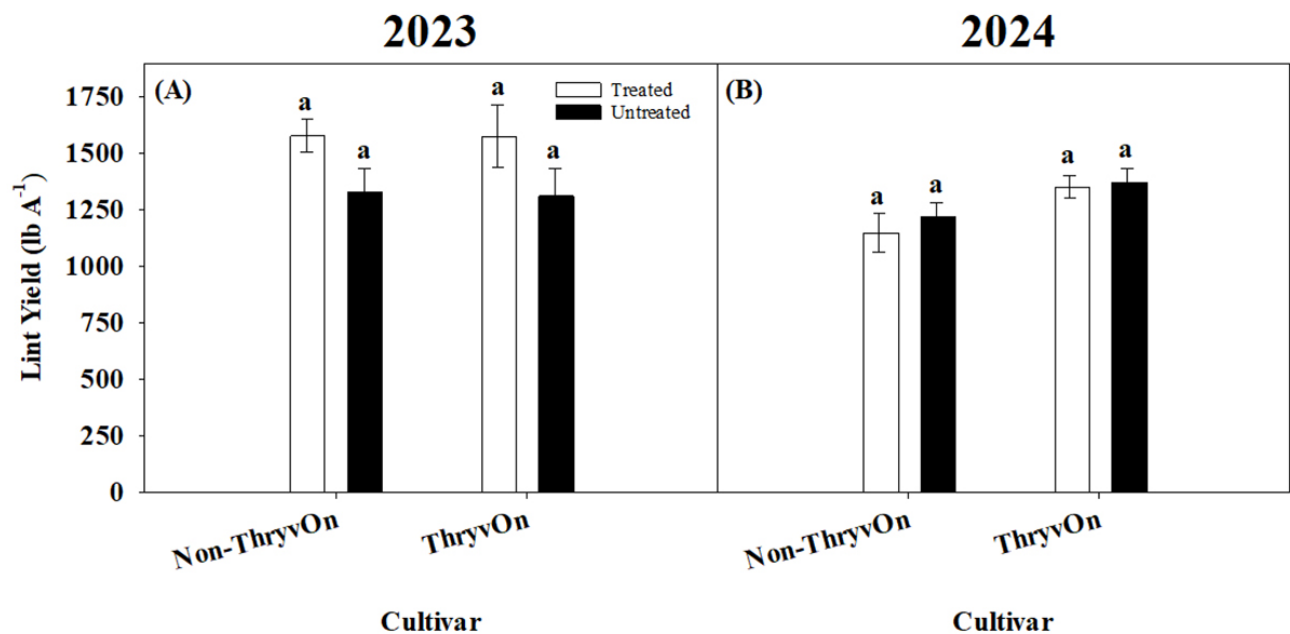


Figure 3. Effects of cultivar and insecticide on lint yield (A and B) in the 2023 and 2024 growing seasons for a field site in Tifton, GA. White bars represent insecticide treated while black bars represent untreated. Bars represent means $\pm$ standard error ($n = 6$). For each graph, bars not sharing a common letter are considered significantly different ($P < 0.05$).

Discussion

Thrips pressure varied in the 2023 and 2024 seasons, despite both crops being planted under predicted high thrips pressure based on the thrips infestation model calculator. Differences in thrips pressure between seasons undoubtedly led to differences in results between the two seasons. As a result, nearly all interactions between cultivar and insecticide treatment were observed during the 2023 season where we observed higher thrips infestations. The ThryvOn cultivar exhibited lower thrips presence and injury than the non-ThryvOn cultivar, irrespective of insecticide treatment. Where interactions were observed, insecticide treatment mitigated pest

pressure and positively impacted crop growth to a much greater extent in the non-ThryvOn cultivar than in the ThryvOn cultivar.

Canopy interception of photosynthetically active radiation (IPAR) is one of the fundamental drivers of yield. In the current study, there was only one date during the 2023 season that the fraction of IPAR intercepted by the canopy ($IPAR_f$) showed an interactive effect of cultivar and insecticide at 48 DAP in 2023 (see [original article](#) in *Agronomy Journal* for figure). Specifically, non-ThryvOn treated intercepted 50% more solar radiation compared to non-ThryvOn untreated. The improved leaf area from thrips protection (via insecticide) led to non-ThryvOn treated having a greater leaf area, which resulted in higher canopy light interception. By comparison, $IPAR_f$ was unaffected by insecticide treatment for ThryvOn on the same sample date, indicating that insecticidal control of early-season thrips was not needed to maintain canopy development in the ThryvOn cultivar.

Despite significant differences in plant injury ratings and crop growth due to thrips feeding in the early season, there were no significant effects of cultivar or insecticide on lint yield (Figure 3). Other researchers have also documented little to no yield loss in cotton plants with and without in-furrow insecticide under moderate to high thrips pressure both with and without ThryvOn technology. Sadras and Wilson (1998) stated that reductions in lint yield due to plant injury from thrips feeding were not observed until shoot growth reductions were 40%. Plants in this study were grown under high-yielding conditions with adequate field conditions, temperature, irrigation, and overall growing conditions; therefore, plants in this study were able to compensate for the early-season damage and produce viable lint yields. The high plant injury ratings observed in the early season did not translate to reductions in yield loss, showing that thrips injury was cosmetic instead of yield-limiting.

Conclusions

Plants with ThryvOn technology exhibited lower thrips presence and injury than the non-ThryvOn cultivar, regardless of insecticide treatment. Where interactions were observed, insecticide treatment mitigated pest pressure and positively impacted crop growth to a much greater extent in the non-ThryvOn cultivar than in the ThryvOn cultivar. Lint yields were not affected by cultivar or insecticide treatment in either year, despite significant plant injury in the early season. This is likely because cultivar and insecticide effects on plant growth only temporarily affected radiation capture by the crop canopy. The data from this study further highlight that newly available ThryvOn cultivars offer significant thrips injury protection relative to non-ThryvOn cultivars, decreasing the need for insecticide application. Thrips injury and reductions in plant growth in the early season may not necessarily translate to yield loss if radiation capture by the crop canopy is eventually maximized and there is sufficient growing season length available to mature the crop.

Dig deeper

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1. What type of pest are thrips primarily considered in cotton production?

- a. Soilborne pathogens.
- b. Mid-season defoliators.
- c. Early-season insect pests.
- d. Late-season boll feeders.

2. Thrips feeding primarily damages cotton plants by

- a. chewing holes in mature leaves.
- b. depositing eggs in bolls.
- c. feeding on root systems underground.
- d. piercing plant tissue and extracting sap.

3. Which of the following is NOT a typical symptom of thrips injury?

- a. Leaf crinkling.
- b. Silvery leaf surfaces.
- c. Deformed leaves.
- d. Enlarged root systems.

4. Why can April-planted cotton be more susceptible to thrips injury?

- a. Increased rainfall reduces plant resistance.
- b. Cooler temperatures slow plant growth.
- c. Higher soil salinity stresses roots.
- d. Reduced daylight limits photosynthesis.

5. What is the primary function of the Thrips Infestation Predictor tool?

- a. Estimating timing and risk of thrips infestation.
- b. Identifying resistant cotton cultivars.
- c. Measuring soil nutrient levels.
- d. Predicting final lint yield.

6. What is the primary way ThryvOn cotton reduces thrips impact?

- a. By accelerating cotton seedling growth.
- b. By reducing egg laying and causing antifeeding behavior.
- c. By increasing natural predator populations.
- d. By killing adult thrips on contact.

7. Why did thrips pressure differ between the 2023 and 2024 seasons?

- a. Weather conditions slowed plant growth more in 2023.
- b. ThryvOn was only used in 2024.
- c. Different cultivars were planted each year.
- d. Insecticide rates were higher in 2024.

8. What was the overall effect of thrips injury and insecticide treatment on lint yield?

- a. Aldicar-treated plots always yielded higher.
- b. Non-ThryvOn cotton always yielded lower.
- c. Both cultivar and insecticide had no significant effect on yield.
- d. ThryvOn significantly increased yield each year.

9. How did severe early thrips injury affect canopy development and interception of photosynthetically active radiation (IPAR)?

- a. It permanently reduces IPAR for the entire season.
- b. It increases IPAR due to compensatory leaf expansion.
- c. It has no measurable effect on IPAR.
- d. It delays canopy development, reducing IPAR temporarily.

10. Why did significant early-season differences in plant injury and canopy development fail to translate into lint yield differences?

- a. Thrips feeding primarily affects reproductive structures, not vegetative growth.
- b. The crop eventually maximized radiation capture and had sufficient season length for full compensation.

- c. ThryvOn cotton expresses yield-stability genes that buffer against stress.
- d. Cotton yield is determined by boll retention, which thrips do not influence.

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