MANAGING WIREWORMS USING PREVENTIVE INSECTICIDE TREATMENTS IN COTTON

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Abstract

True wireworms (Elateridae: Coleoptera) and false wireworms (Tenebrionidae: Coleoptera) are common pests of cotton (*Gosssypium hursutum* L.) in the Texas High Plains. Wireworms damage cotton by feeding on the roots, hypocotyl, and cotyledon of plants before emerging from the soil and reducing the stand. Experiment was conducted in a field with known history of wireworms to determine the impact of insecticide seed treatments and at-plant in-furrow application on wireworm injury, stand establishment, lint yield and fiber quality. Significantly fewer number of seedlings were damaged by wireworms in treated plots compared to the untreated check. Insecticide treatments had a significant positive impact on the stand establishment. The average plant height, number of main-stem nodes, position of 1st fruiting node on the main stem, boll maturity, lint yield and fiber quality did not vary significantly across treatments. Overall, results from this field trial indicate that insecticide seed treatments and at-plant applications can help minimize wireworm injury in cotton and help achieve better plant stand.

Introduction

Wireworms have become a common cotton (*Gossypium hirsutum* L.) pest in the Texas High Plains (Vyavhare and Kerns 2017). Two types of wireworms feed on cotton: true wireworms and false wireworms. True wireworms, commonly called click beetles, are members of the Elateridae family (Order: Coleoptera), while false wireworms, or darkling beetles, are from the Tenebrionidae family (Order: Coleoptera). Wireworms damage cotton by feeding on the root, hypocotyl, and cotyledon of plants before emerging from the soil. The most severe damage occurs when the hypocotyl is severed, killing the plant and reducing the stand. The incidences of wireworm infestation especially in no-tillage and minimum tillage fields and fields followed by grain crops are on rise in the High Plains of Texas (S. V., personal observation). Since wireworms are subterranean, no effective sampling technique exist for monitoring of this pest nor the well-established economic threshold. Furthermore, there are no rescue treatments available against wireworms as a result cotton producers often need to replant problem fields as heavy infestations result into less than acceptable plant stand. Wireworms being generalists, feed on a large variety of crops and can live in the soil for 2–11 years, depending on the species and environmental conditions (Karren and Roe 2020). The longer life cycle of wireworms and wide host range makes it challenging to implement effective crop rotation strategy against this pest (Traugott et al. 2015). Insecticide seed treatments at-plant applications can provide protection against wireworms to some extent; however, limited information is available on the efficacy of such treatments against wireworms in cotton. This research was conducted with an objective to determine the impact of at-plant insecticide treatments on cotton plant stand, lint yield and quality under wireworm infestation. Prior to planting, wireworm infestation in the research field was confirmed using pre-plant bait traps made of soaked wheat as described by (Rashed et al. 2015).

Materials and Methods

Field study was conducted during 2020 growing season at the Texas A&M AgriLife Research and Extension Center in Lubbock, TX. The experiment was planted on 11 June 2020 (cotton variety: DP1948B3XF) with a 4-row cone planter under flood irrigated condition. The experiment was conducted as a randomized complete block design with four replicates. Each plot was 4 rows (40-inch centers) x 36 ft long. Treatments evaluated included untreated check; seed treatments: Gaucho 600, Acceleron Elite, Orthene 97 at 10 oz/ cwt, and Avicta Elite; and at-plant in-furrow application of Admire Pro at 9.2 fl oz/a, and Gaucho 600 seed treatment + in-furrow application of Fanfare ES at 6.4 fl oz/a. Fertility, weed control, and insect management were in accordance with the Texas A&M AgriLife Extension Service guidelines. At crop emergence, randomly selected 10 ft long section of one of the middle two rows was marked using wooden stakes. Data on the plant stand were collected by counting cotton seedlings in the marked 10 ft area at cotyledon, 3 true leaves, and squaring stages of cotton. To determine the percentage of wireworm injured plants, 10 randomly selected plants were removed from the outer two rows of each plot at cotyledon and 3 true leaves stages and taken to the laboratory. These seedlings were visually inspected for the signs of wireworm feeding on stem and tap root. Data on the number of ≥3 ft long skips in plant stand were taken from the middle two rows of each plot at beginning of bloom stage of cotton. Measurements on plant height, number of main-stem nodes per plant and position of 1st fruiting branch on the main stem were taken from five adjacent plants in the center of each plot during peak bloom stage. Data on boll maturity was collected by counting number of open and unopened bolls on a group of five adjacent plants randomly selected from the two middle rows of each plot. At maturity, marked 10 ft long section of each plot was hand harvested. The percentage of lint in seedcotton and lint yield were determined by ginning the seedcotton in the research cotton gin at the Texas A&M AgriLife Research center in Lubbock. A 60-g fiber sample was taken from each plot after ginning and submitted for fiber analysis using High Volume Instrument (HVI) system at the Fiber and Biopolymer Research Institute at Texas Tech University in Lubbock, Texas. Data were analyzed by analysis of variance (ANOVA) in Agricultural Research Manager software (GDM Solutions, Inc.). Means were compared using Tukey's HSD. To meet the assumptions of ANOVA, data on percentage of wireworm injured plants were transformed using arcsine square root % transformation. All statistical differences were determined using alpha level 0.05.

Results and Discussion

Plant stand did not vary significantly across treatments at cotyledon ($P = 0.165$) and 3 true leaves ($P = 0.0745$) stages of cotton (Fig. 1). The final plant stand, however, varied significantly across treatments ($P = 0.0449$). Overall, plant population in treated plots was substantially higher than the untreated check.

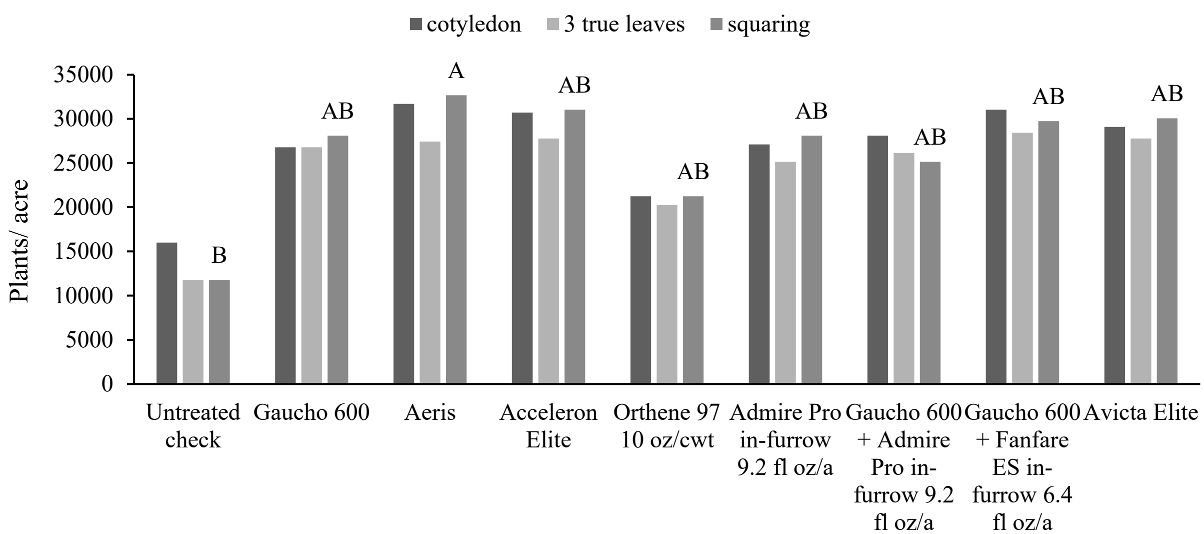

Fig. 1. Plant stand at cotyledon, 3 true leaves, and squaring stages of cotton. Means with the same letter are not significantly different from each other (alpha = 0.05).

Percentage of cotton seedlings with wireworm injury did not vary significantly at cotyledon stage ($P = 11.38$) (Fig. 2). At 3 true leaves stage of cotton, percentage of wireworm injured plants varied significantly across treatments ($P = 0.0012$). Overall, substantially greater number of cotton seedlings in untreated plots exhibited wireworm feeding injury than the seedlings in treated plots.

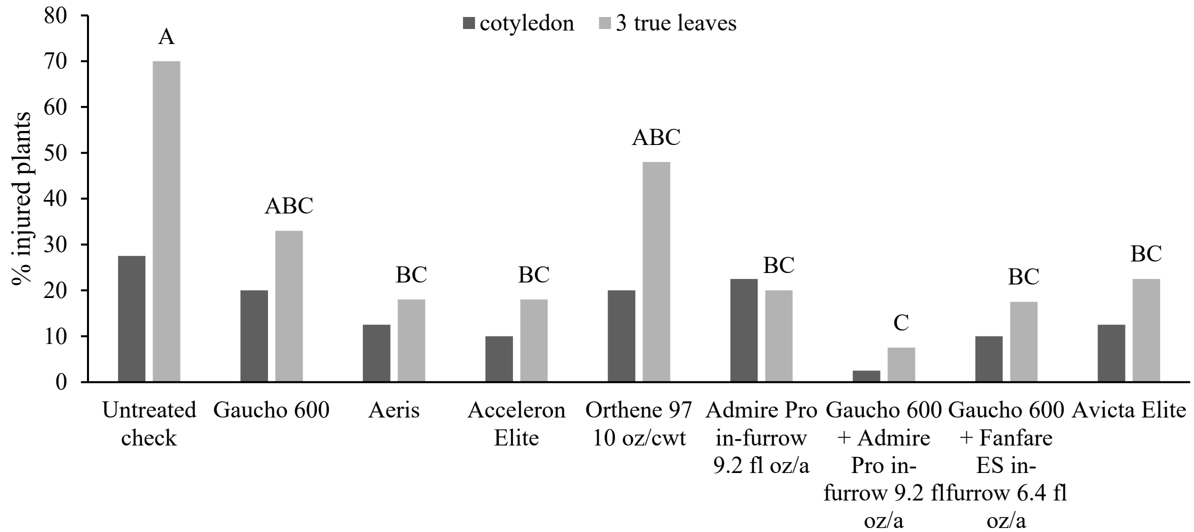

Fig. 2. Percentage of wireworm injured cotton seedlings across treatments at cotyledon and 3 true leaves stages of cotton. Means with the same letter are not significantly different from each other (alpha = 0.05).

Number of ≥3 ft skips in plant stand (P = 0.8064), the average plant height (P = 0.5492), number of main stem nodes (P = 0.7514), and the position of first fruiting branch on the main stem (P = 0.3034) did not vary significantly across treatments. Similarly, there was no statistically significant treatment impact on the boll maturity (P = 0.5510) and lint yield (P = 0.3848) (Fig. 3). Finally, no significant differences were observed in fiber properties such as micronaire (P = 0.8194), fiber length (P = 0.5870), uniformity (P = 0.9105), strength (P = 0.2620), and elongation (P = 0.0993). Results from this study indicate that insecticide seed treatments and at-plant in-furrow applications can help minimize wireworm injury to cotton seedlings and achieve better stand establishment.

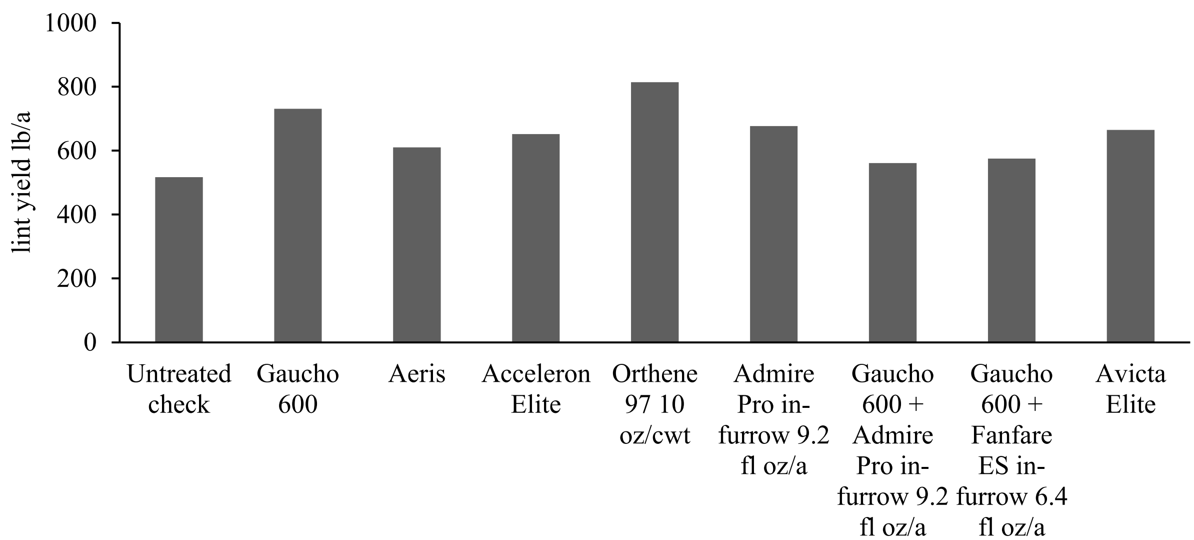

Fig. 3. Cotton yield response to at-plant insecticide treatments in wireworm infested field.

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