Thrips threshold validation – commercial-scale experiments

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Key findings

» Thrips pressure reached the positive control threshold of one thrips per plant in late October while plants were at the cotyledon to 1-leaf stage.

» Thrips pressure reached the industry threshold of 10 thrips per plant in mid-November when plants were at the 4–5-leaf stage.

» Onion thrips were the dominant thrips species observed during monitoring.

» Western flower thrips (WFT) constituted less than 5% of thrips monitored.

» There was no yield difference between sprayed and unsprayed plots.

Introduction

Thrips are common seedling pests of cotton in most growing districts. They feed on growing terminals causing leaf distortion and sometimes death of the terminals. Heavy infestation can result in yield loss and delayed maturity. Most insecticides applied in the southern cotton production region are targeted against thrips. The cotton industry thrips spray threshold of 10 thrips per plant and >80% leaf area loss from seedling to 6-leaf stage was developed and validated in many research experiments in the northern production areas (Wilson and Room 1983; Sadras and Wilson 1998; Wilson 1999, 2002, 2005; Wilson et al. 2003; Lei and Wilson 2004; Cotton Info 2015). The southern production areas have a shorter season than the northern production areas and early crop establishment has been strongly linked to high yields.

These experiments were conducted to evaluate whether thrips controls applied at the thrips threshold led to higher or lower yields when compared with treatments at a lower threshold (one thrips per plant) and a non-spray treatment. The local cotton industry supported commercial-scale experiments over small plot experiments.

WFT (*Frankliniella occidentalis*) is a widespread thrips pest in horticultural production in the Riverina and was anticipated to be relatively more important in southern cotton than the northern production areas. WFT is a species that is highly resistant to most registered thrips insecticides, hence the treatment options needed to include insecticides that were expected to be efficacious against WFT.

Dimethoate and omethoate are two thrips insecticides permitted or registered in cotton that are relatively ineffective against WFT. Fipronil is another foliar insecticide registered for thrips in cotton, which is effective against WFT, however it is highly toxic to bees and both our commercial scale experiment areas were near horticultural crops, so it was initially agreed to avoid it as a treatment. Sulfoxaflor is newly registered in cotton for aphid control. Baseline insecticide resistance testing in the Dr Grant Herron's laboratory (Biosecurity NSW) based at Elizabeth Macarthur Agricultural Institute, found that it had good activity against WFT, hence its use as the positive control. Similarly, another newly registered cotton insecticide, Cyantraniliprole, showed laboratory activity against WFT and was used in a second threshold treatment in the larger of the two commercial threshold experiments. A petroleum spray oil was used as a third threshold treatment, also in the larger commercial threshold experiment.

Site details

Location	**Smaller experiment**: Irrigation Research and Extension Committee (IREC) demonstration site, Whitton [145.92 E; -34.65 S] **Larger experiment**: Point Farms (PF), Darlington Point [145.91 E; -34.65 S]
Cooperators	Matt Stott (owner PF and current lessee of IREC demonstration site); James Hill (agronomist) and farm operations staff
Sowing date	1 October 2014 (IREC); 10 October 2014 (PF)

1st Water	1 October 2014 (IREC); 14 October 2014 (PF)
Variety	Sicot 74BRF
Seed treatment	Dynasty® – azoxystrobin+ metalaxyl-M+ fludioxonil
Irrigation	Drip (IREC); furrow (PF)
Establishment	6 plants/m^2 (IREC); 9.6 plants/m^2 (PF)
Hand harvest date	7 May 2015 (IREC); 14 May 2015 (PF)
Machine harvest date	26 May 2015 (IREC); 23 May 2015 (PF)

Treatments

T1: Unsprayed	Dynasty® fungicide seed treatment only
T2: Trans 1	Dynasty® and Cruiser® seed treatment + Transform® at one thrips per plant
T3: Trans 10	Dynasty® + Transform® at 10 thrips per plant
T4: Exirel 10	Dynasty® + Exirel® at 10 thrips per plant
T5: Oil 10	Dynasty® + Canopy Oil® at 10 thrips per plant
T1-3	IREC site
T1-5	PF
T1	negative control
T2	positive control
Transform®	sulfoxaflor 240 g/L Group 4C; rate: 300 mL/ha + Agral
Exirel®	cyantraniliprole 100 g/L Group 28: rate: 600 mL/ha + Hasten
Canopy oil®	paraffinic oil C27 792 g/L 2%v/v
Regent®	fipronil 800 g/L WG Group 2B; rate 125 mL/ha

Experiment details

Trial design	Randomised block-plot
Plot size	IREC: 12 beds (2 rows to a bed) × 1.8 m beds × 750 m = 1.62 ha PF: 12 beds (2 rows to a bed) × 1.8 m beds × 420 m = 0.91 ha
Replicates	4
Monitoring dates	IREC: 21 October, 27 October, 3 November, 13 November, 20 November, and 1 December 2014 PF: 27 October, 3 November, 10 November, 17 November, 25 November and 4 December 2014
Sample unit	10 whole random plants
Monitored	Thrips adults, nymphs and species composition
Analysis	Analysis of Variance (ANOVA), significant treatment effects were detected (P <0.05), treatment means were separated by Fisher's l.s.d.

Results

IREC

Thrips pressure was similar in all plots before the first spray (Figure 1). Onion thrips (*Thrips tabaci*) was the dominant thrips species with 80% of all adult thrips monitored from seedling to 17-leaf stage (Figure 2). Other thrips species observed were: tomato thrips (*Frankliniella schultzei*), western flower thrips (*F. occidentalis*), plague thrips (*Thrips imaginis*) and some predatory thrips species.

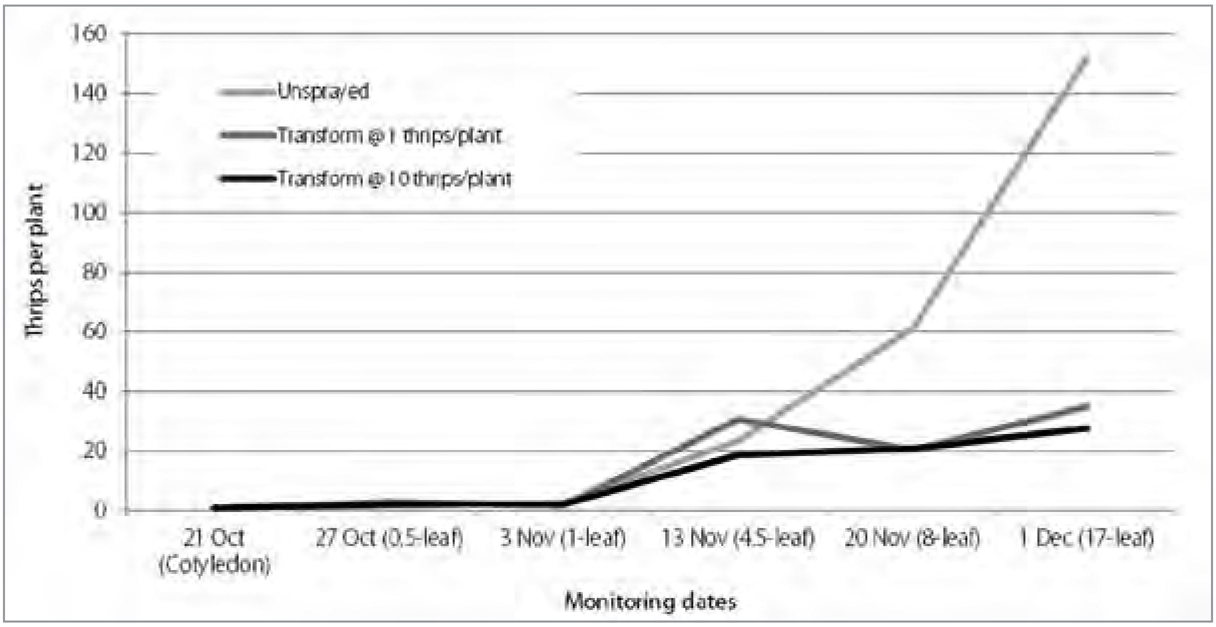


Figure 1. Total numbers of thrips per plant at each monitoring date from 20 whole plant washes from each plot–IREC.

crop protection

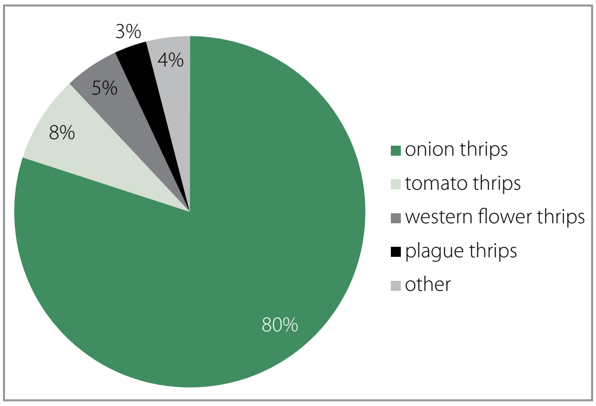


Figure 2. Breakdown of total adult thrips by species collected between 21 October and 1 December 2014 from the IREC experiment site.

The low threshold was reached in late October and the high threshold in mid-November. Two sprays of Transform® were applied before the high-threshold sprays were triggered. Neither showed any effects in thrips control (P >0.05) (Figure 3). In fact, larval thrips numbers had continued to increase despite the two sprays. In an effort to bring down thrips numbers in the positive control plots, Fipronil was applied in lieu of Transform® in these plots at the time when the first high-threshold sprays were triggered.

Following this round of sprays, larval thrips numbers in both Fipronil-treated plots (positive control plots) and plots receiving the high-threshold Transform® sprays were significantly reduced compared with the negative control plots (P <0.05). The significant effects persisted at the last assessment following a further round of high-threshold sprays (P <0.05). It is worth noting that although thrips pressure remained relatively high in the two spray treatments (>10 thrips per plant), the density was less than a quarter of that in the negative control plots.

There were no significant differences in lint yield (kg/ha) among the threshold treatments in the hand harvest data (P >0.05) (Figure 4) at the IREC site. Machine harvest data are yet to be finalised.

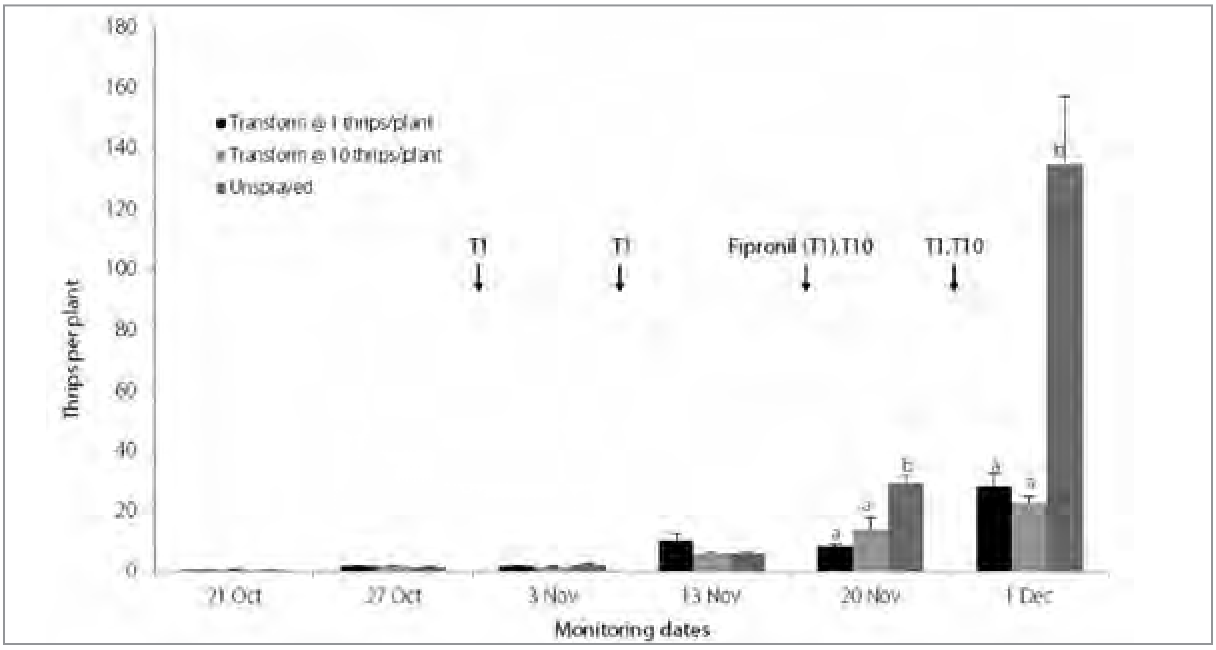


Figure 3. Comparing average numbers of larval thrips in different threshold treatments at IREC. Trans 1 – Transform applied at one thrips per plant, Trans 10 – Transform applied at 10 thrips per plant. Bars in the same group labelled with different letters were significantly different at P = 0.05 by Fisher's l.s.d. tests after detecting significant overall treatment effects by ANOVA. Error bars show the standard errors. Arrows indicate spray timings.

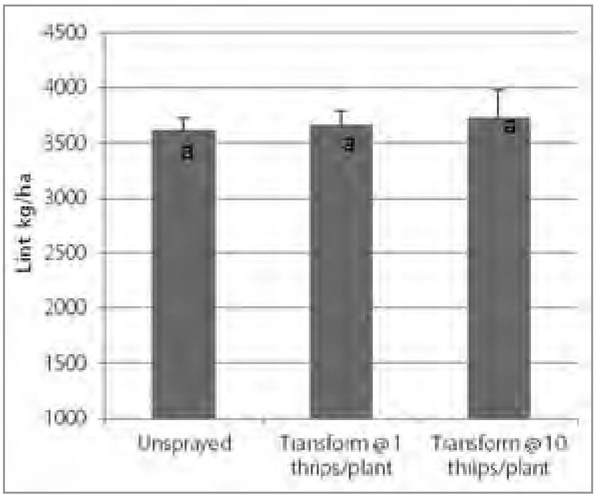


Figure 4. Effects of threshold treatments on lint yield (kg/ha) in the hand harvest data at the IREC site. Bars sharing the same letters were not significantly different at P = 0.05 by Fisher's l.s.d. tests after detecting significant overall treatment effects by ANOVA. Error bars show the standard error.

Point Farms

Thrips pressure was similar in all plots before the first spray (Figure 5).

Similarly to the IREC site at Point Farms, onion thrips (*Thrips tabaci*) was the dominant thrips species with 71% of all adult thrips monitored from seedling to 17-leaf stage (Figure 6). Other thrips species observed were: tomato thrips (*Frankliniella schultzei*), western flower thrips (*F. occidentalis*), plague thrips (*Thrips imaginis*) and some predatory thrips species.

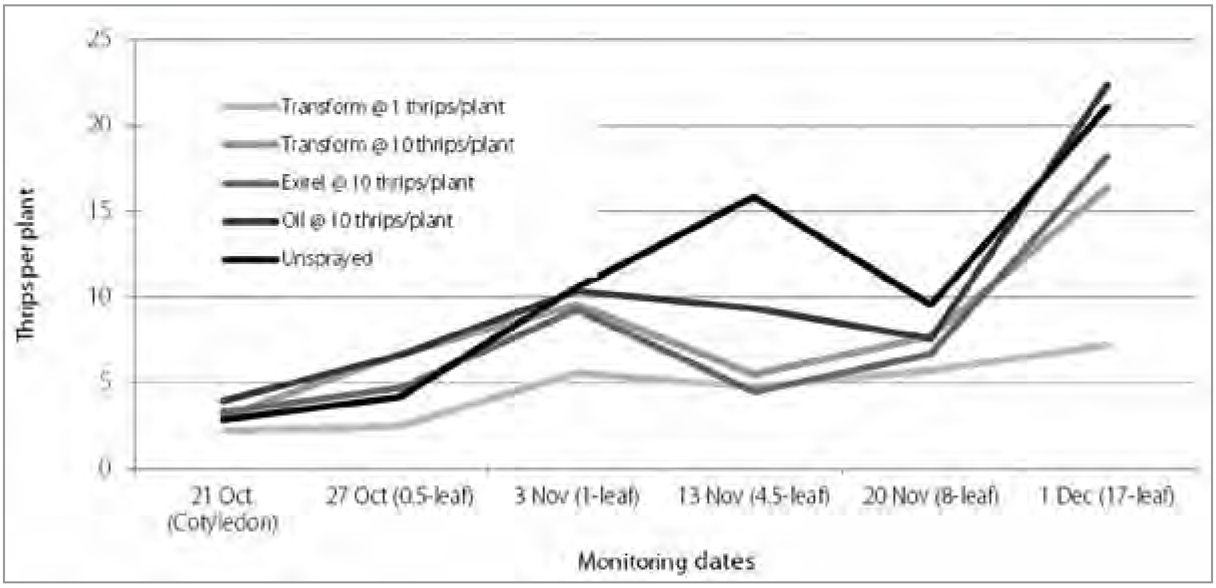


Figure 5. Total numbers of thrips per plant at each monitoring date from 20 whole plant washes from each plot.

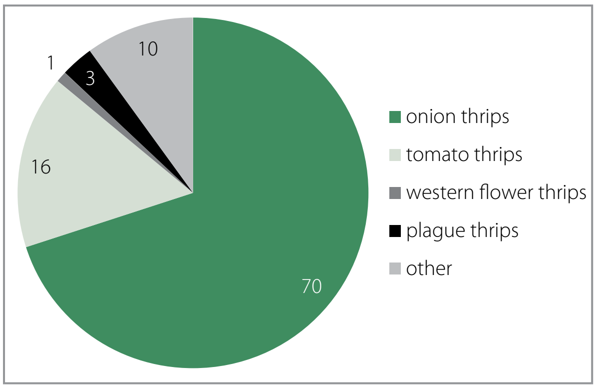


Figure 6. Breakdown of total adult thrips by species collected between 27 October and 4 December 2014 from the Point Farms experiment site.

The low threshold was reached in late October and the high threshold in mid-November. Five sprays of Transform® were applied at the low threshold, one spray each of Transform® and Exirel® at the high threshold, and two sprays of oil at the high threshold. The first two low-threshold sprays of Transform® were applied before any of the high-threshold sprays were triggered. Both sprays reduced the numbers of larval thrips in the positive control plots to about half of that in the un-sprayed plots (negative control plots and plots assigned for the three high-threshold treatments) (Figure 7).

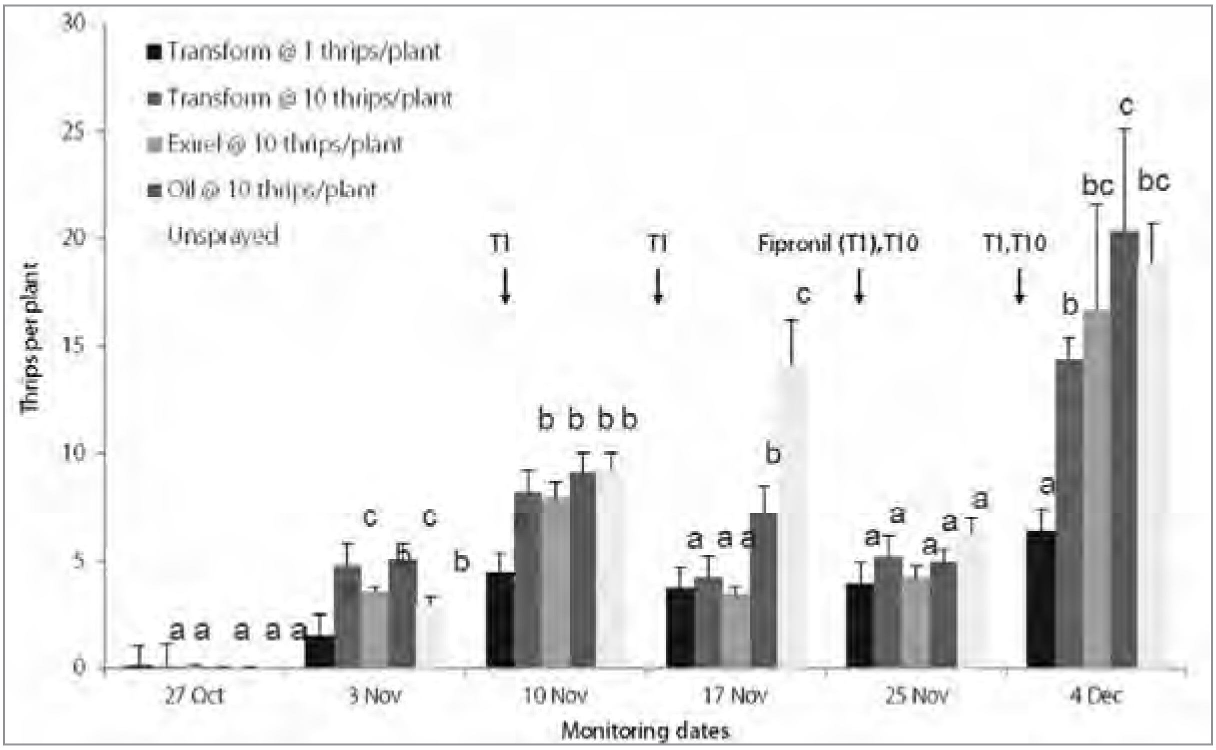


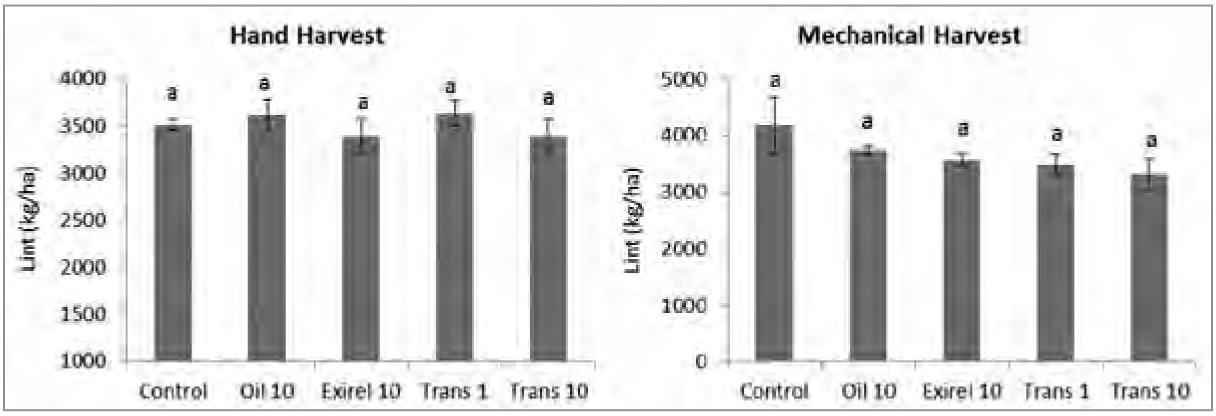
Figure 7. Comparing average numbers of larval thrips in different threshold treatments at Point Farms. Trans 1 – Transform applied at one thrips per plant, Trans 10 – Transform applied at 10 thrips per plant, Exirel® 10 – Exirel® applied at 10 thrips per plant, Oil 10 – Canopy oil® applied at 10 thrips per plant. Bars in the same group labelled with different letters were significantly different at P = 0.05 by Fisher's l.s.d. tests following detection of significant overall treatment effects by ANOVA. Error bars show the standard errors. Arrows indicate spray timings.

In mid-November, a single spray of Transform® and Exirel® at the high threshold also significantly reduced larval thrips numbers (P <0.05), bringing down the population to a similar level to those in the positive control plots, which had already been sprayed twice before with Transform®. The first oil spray at the high threshold also significantly reduced larval thrips compared with the negative control plots (P <0.05), however, the reduction was significantly less than the other two high-threshold treatments. Oil was applied again at the high threshold in the following week, but failed to show significant effects of thrips control (P >0.05). At the last assessment, only the positive control plots maintained significantly lower numbers of larval thrips than the negative control plots (P <0.05).

There were no significant differences in lint yield among the threshold treatments in either the hand harvest data or the machine harvest data at the Point Farms site (P >0.05) (Figure 8).

Summary

No yield differences were observed in plots where thrips were uncontrolled versus plots where thrips were sprayed with insecticides at either one thrips per plant (positive control) or at the cotton industry threshold of 10 thrips per plant at either of two commercial-scale experiments. Thrips pressure reached the 10 thrips per plant threshold by mid- November when plants were at about the 4 to 4.5-leaf stage at both sites. Eighty-three per cent of the adult thrips monitored up to the 15-leaf stage were onion thrips. Tomato thrips constituted 13% of the thrips population and other species made up no more than 2% each. The positive control plots received four and five foliar insecticide sprays at the Whitton and Darlington Point sites respectively; the industry threshold treatment plots received two foliar insecticide sprays. The experiments are part of a project to validate whether the Australian cotton industry thrips threshold applies in southern NSW cotton production areas. The treatment plots were 1.62 ha (Whitton) and 0.9 ha (Darlington Point) and replicated four times.



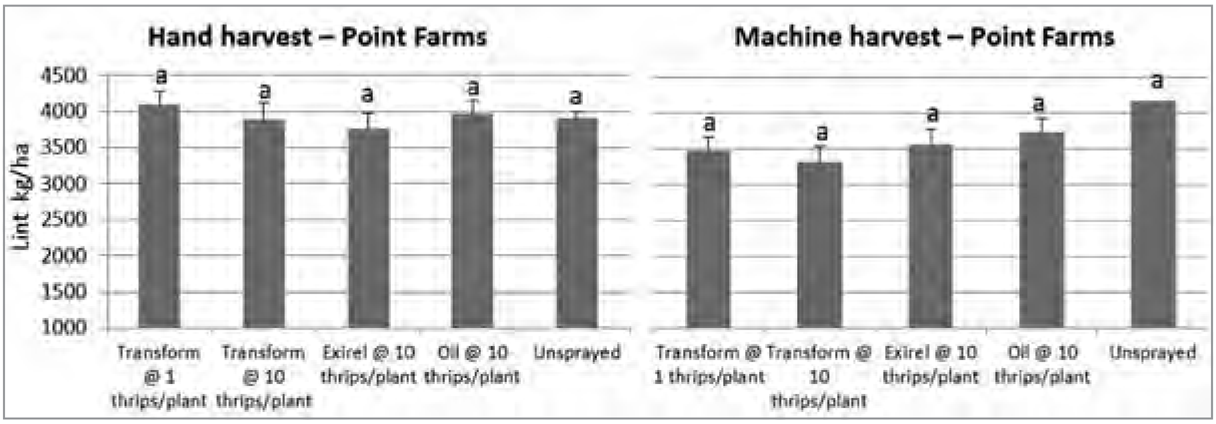


Figure 8. Effects of threshold treatments on lint yield (kg/ha) in the hand harvest data (left) and the machine harvest data (right) at the Point Farms site. Bars sharing the same letters were not significantly different at P = 0.05 by Fisher's l.s.d. tests after detecting significant overall treatment effects by ANOVA. Error bars show the standard error.

Foliar insecticide sprays were applied using a ground rig and yields assessed from both hand harvest samples and at least one commercially harvested round module per plot. Turn-out was determined from hand-ginned samples from the hand harvest.

Acknowledgements

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