Grower Summary

PC 302b

Tomato: Phase 3 of contingency plans for the control of Tuta absoluta

Final 2012

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Further information

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HDC
Stoneleigh Park
Kenilworth
Warwickshire
CV8 2TL

Tel – 0247 669 2051

HDC is a division of the Agriculture and Horticulture Development Board.

Project Number:	PC 302b
Project Title:	Tomato: Phase 3 of contingency plans for the control of Tuta absoluta
Project Leader:	Paul Howlett
Contractor:	Wight Salads Group
Industry Representative:	Mr Philip Pearson, TGC Technical Committee
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Headline

- Nemasys® (*Steinernema feltiae*) provided 40-50% control of *Tuta absoluta* larvae.
- A spinosad containing product controlled *T. absoluta* larvae when applied through the irrigation system of a rockwool-grown crop.
- A UV light trap was shown to be attractive to both male and female *T. absoluta* moths.

Background

Tuta absoluta (Meyrick) was first intercepted in the UK on Spanish imports in March 2009 and there soon followed an outbreak in a commercial crop. The pest has since become established on several sites across the country. The larvae cause extensive damage by mining in leaves and fruit. It is currently considered to be the most important pest of UK tomato crops (Jacobson, 2012). One grower with a nursery in Portugal has been working towards a robust IPM programme for *T. absoluta* since the pest's arrival at their production site in Portugal in 2008. Based on experience gained in Mediterranean countries during 2009 and 2010, a theoretical season-long IPM strategy was designed based on the predatory bug, *Macrolophus* spp. Potentially useful components of that programme have been tested in this project and elsewhere using a 'modular' approach. This has involved testing each module independently to determine whether it is effective against *T. absoluta*, compatible with other components of the whole IPM programme and economically viable. This report describes the modular studies commissioned by HDC in 2010 and completed during 2011 and 2012.

Summary

The overall aim of the project was to develop cost-effective and sustainable IPM strategies for *T. absoluta* that were acceptable within organic tomato production in the UK. Specific technical objectives were to:

1. evaluate entomopathogenic nematodes against *T. absoluta*
2. refine methods of applying products through the irrigation system
3. evaluate combined pheromone and light traps

Evaluation of entomopathogenic nematodes against T. absoluta

A 'proof of concept' trial showed that two species of entomopathogenic nematodes, *Steinernema feltiae* (as Nemasys®) and *S. carpocapsae* (as NemasysC®) were capable of killing *T. absoluta* larvae within 2-6 days of application and producing offspring within dead larvae. However, the rates used (10m infective juveniles / litre), were relatively high and the cost was about seven times greater that of a standard chemical insecticide. There followed further trials to determine which was the more effective of the two nematode species and to

establish the most cost-effective application rate. Based on those results, treatment with *S. feltiae* diluted to 1m infective juveniles / litre was carried forward to the next stage of the project.

There were two consecutive trials in a mature 1.17 ha organic tomato crop (cv. Sunstream). *Steinernema feltiae* was applied at dusk at 1m / litre using a Berg self-propelled, robotic sprayer. The unit carried two vertical booms, one spraying to the left of the sprayer, the other to the right. As most of the active *T. absoluta* mines were in the lower two thirds of the canopy, the booms were set up to target this stratum of the crop. The sprayer was calibrated to spray to the point of run off on both sides of the leaves delivering approximately 2,500 litres / ha. There were six monitored plots within the treated area. Within each plot, 40 infested leaflets were marked and monitored over 10 days post-treatment. There was an additional untreated plot in the first trial but not in the second due to the risk of substantial crop damage.

The results of both crop-scale trials are shown in Figure A. There was very little natural mortality. In trial 1, dead *T. absoluta* larvae were seen in the *S. feltiae* treatments three days post-treatment. By day 10, mortality in the plots ranged from 15% to 71% (overall mean 49.8%). At least one nematode was found in each dead *T. absoluta* larvae, thus confirming the cause of death. One plot showed considerably reduced mortality because some nozzles were temporarily blocked. If data from that plot were excluded, then the overall mortality rose to 56%. The results of the second crop-scale trial were similar to trial 1 but overall mortality was lower (range 32% to 53%; mean 40.3%). The environmental conditions for the second crop-scale trial were less favourable than the first trial for nematode activity on the leaf surface; the mean night temperature of 20.6^{o}C and relative humidity of 74% being 3.1^{o}C higher and 9% lower respectively. As a consequence, the spray dried on the leaves more rapidly, restricting the time available for nematodes to find an entrance hole.

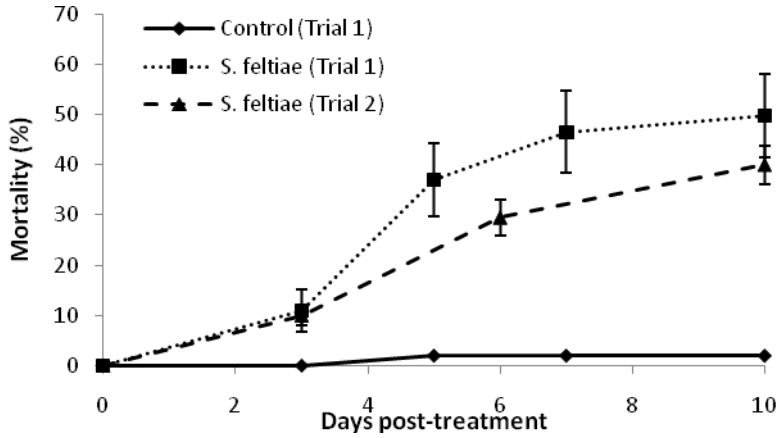

Figure A. The mean percentage mortality of *Tuta absoluta* larvae in infested leaves after crop wide applications of *Steinernema feltiae* using a robotic sprayer.

Spinosad applied via the irrigation system

There were two consecutive trials in a mature 1.28 ha conventional rockwool-grown tomato crop (cv Mecano). The crop was bisected by a central concrete road which created two similar 'plots'. Each plot comprised 80 rows of plants trained in a 'V' formation and there were approx 24,320 heads per plot at the time of the trial. For the first trial, the west side of the glasshouse was the 'treated' plot and the east side was the untreated control. The treated area was served from an irrigation manifold positioned at the end of the central row beside the concrete road. The manifold split the irrigation flow with separate pipe work serving equal crop areas to the north and south. New valves were plumbed into each manifold pipe to connect a Dosatron diluter. The treatment was applied in week 28 2012 with the Dosatron on the 0.5% setting. 775 ml of a product containing spinosad at 120 g/l was diluted in 65 litres of water to provide the 'concentrate' and this was delivered to the plants in a total of 13,000 litres of water over 3 complete irrigation rounds.

Nine formal sample stations were set up throughout each plot to measure efficacy against *T. absoluta*. Each sample station comprised a batch of 10 plant heads giving a total of 90 inspected heads per plot. The top seven expanded leaves (*i.e.* approx 0.6m of growth) of each head were inspected immediately prior to treatment and the numbers of active *T. absoluta* mines recorded. The assessments were repeated in weeks 29, 30, 32 and 33. The size of the *T. absoluta* populations were thus compared between plots and the changes monitored over time. On the same dates, numbers of *Macrolophus* were assessed in three complete rows of plants. The head of every fifth plant was beaten over a white tray and numbers of *Macrolophus* adults and nymphs recorded.

The results in the first trial were extremely clear. There was an average of 14.4 active mines per plant head in the formal sample stations immediately prior to the application of the spinosad product. This declined to 0.1 active mine per plant head one week after treatment. No active mines were found in the sample stations during the subsequent four weeks. In contrast, numbers of active mines per plant head in the untreated control increased from 22.3 pre-treatment to 155.2 one week post-treatment. The untreated control was then deemed to have served its purpose and action was taken to prevent more serious crop damage. Numbers of *Macrolophus* steadily increased from 0.05 per plant head in week 28 to 2.9 per plant head in week 33 in the treated plot.

For the second trial, the east side of the glasshouse became the treated plot. The treatment was applied in week 29 2012 following the same procedure as in the first trial. Numbers of active *T. absoluta* mines and numbers of *Macrolophus* were recorded following the same procedures as described for the first trial. There was no untreated control in this trial and so the changes in size of the *T. absoluta* and *Macrolophus* populations were monitored over time. The results were as clear as the first trial. Numbers of active mines per plant head declined from 155.2 immediately before treatment to 1.7 per plant head one week post-treatment. No active mines were found in the sample stations during the subsequent four weeks. Numbers of *Macrolophus* increased from 0.1 per plant head in week 29 to 1.5 per head in week 33.

Evaluation of UV light traps

A series of four trials in 2.34ha glasshouses assessed the efficacy of different components of a prototype UV light trap and thereby determined the best overall combination. The first trial compared the attractiveness of UV strip lamps with and without diffusers fitted. The second and third trials compared sticky traps with water traps as a means of collecting the moths which were attracted to the lamps. The fourth trial compared the efficacy of the sticky base when orientated vertically and horizontally below the UV lamp. The traps were positioned below the leaf canopy among the bare plant stems. The UV lamps were illuminated for five hours each night with the lit period ending one hour after dawn. The numbers of moths captured was recorded and a sub-sample from each treatment was examined to determine their gender.

The traps performed better without the diffuser fitted to the UV lamp. Sticky traps proved to be more effective than water traps as a means of collecting the moths. There were consistently more adult moths on sticky traps when positioned horizontally than when positioned vertically with the overall mean being 2.4 times greater for the horizontal position.

It was presumed that the horizontal sticky platform provided a more favourable 'roosting' site for the moths. There were similar proportions of males to females in the traps.

Financial Benefits

- *Tuta absoluta* is currently the most important pest of tomato crops in the UK. For example, at one nursery during June and July 2012, 30% of fruit were damaged by the pest and graded out. This represented losses of approximately £50k per hectare to that grower for that period alone.
- The studies described in this report are contributing to the development of a robust control strategy for *T. absoluta* which can be integrated into the existing IPM programme for tomato crops. This will minimise the risk of losses for UK growers.

Action Points

- The entomopathogenic nematodes, *Steinernema feltiae* (as Nemasys®) can contribute to an overall IPM programme by slowing down *T. absoluta* population growth while the primary biological control agents, *Macrolophus*, become established in the crop. Their use in the first half of the growing season could be particularly important in organic crops where the limited number of allowed spinosad treatments can be held back until later in the season when fruit damage becomes a more serious issue.
- A spinosad product provided control of *T. absoluta* larvae when applied through the irrigation system of a rockwool-grown crop. It should be noted that this treatment is based on an EAMU which is only for use with a Plant Health Order specifically for the control of *T. absoluta*. The treatment was compatible with *Macroplophus* predators.

A UV light trap may form part of the IPM programme and the optimum number of traps per hectare will be established in a later phase of the work.