Grower Summary

CP 124

Managing ornamental plants sustainably (MOPS)

Final 2017 - Efficacy of plant protection products against sucking insects – western flower thrips / protected ornamentals

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Project title:	Managing ornamental plants sustainably (MOPS)
Project number:	CP 124
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Work package leader:	Jude Bennison, ADAS
Report:	Final report, February 2017
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GROWERS SUMMARY

Headline

- A novel conventional insecticide and a tank mix of the biopesticides Botanigard WP and Majestik improved control of WFT by the predatory mite *Neoseiulus cucumeris* on verbena.
- On some dates adding the sugars adjuvant Attracker improved control of WFT by the conventional insecticide.

Background and expected deliverables

Western flower thrips (WFT), *Frankliniella occidentalis* is a common pest of many ornamental crops, mainly under protection. Feeding damage by adults and larvae on leaves and petals causes white flecks or patches, which later turn brown and necrotic. In addition to causing direct damage which can make the plants unmarketable, WFT can also transmit tospoviruses including *Tomato spotted wilt virus (*TSWV) and *Impatiens necrotic spot virus* (INSV). These viruses also have a wide ornamental host range and can cause severe damage and plant losses. WFT is resistant to most or all currently approved chemical pesticides on many ornamentals nurseries.

A laboratory experiment tested the efficacy of insecticide and biopesticide products against WFT on a susceptible protected ornamental species under controlled conditions. A subsequent glasshouse experiment tested the potential of the most promising treatments from the laboratory experiment in supplementing WFT control by the predatory mites *Neoseiulus cucumeris* within an IPM programme on a protected ornamental species.

Summary of the work and main conclusions

Laboratory experiment

Materials and methods

Nine treatments including seven plant protection products (Table 1) were tested against western flower thrips (WFT), *Frankliniella occidentalis* on pot chrysanthemum flowers in a laboratory experiment at ADAS Boxworth between July and August 2016. There were seven replicates of each treatment with each replicate consisting of a detached pot chrysanthemum flower with a stem. The stems of individual flowers were placed in a dampened cube of Oasis® and placed into individual ventilated Perspex boxes. Ten WFT adult females from the ADAS WFT laboratory culture were released into each box. The WFT population was confirmed to

be resistant to spinosad (Conserve) in a laboratory test in May 2014 and is likely to be resistant to most other insecticides currently approved for use on protected ornamentals. This is typical of WFT on most commercial ornamentals nurseries.

Table 1. Products tested in the laboratory experiment

MOPS code number/active ingredient	Biopesticide or conventional pesticide
Water control	-
Actara (thiamethoxam) – positive control	conventional
130 (azadirachtin)	biopesticide
179 (orange oil)	biopesticide
201 (Met52 OD)	biopesticide
200	conventional
200 tank mixed with fructose, sucrose & saccharose (Attracker)	conventional plus adjuvant
62 (terpenoid blend)	conventional
Beauveria bassiana (Botanigard WP) tank mixed with maltodextrin (Majestik)	biopesticides

Two hours after adding the WFT the treatments were applied with a hand-held sprayer to give good flower cover, just prior to run-off, equivalent to 600 L/ha. The treatments were applied at the supplier's recommended rates and spray intervals and specific adjuvants were only used when recommended by the suppliers. The treatments were applied twice at 7-day intervals except for orange oil which was applied five times at 3-day intervals and Botanigard WP plus Majestik which was applied three times at 5-day intervals. The boxes were kept in a controlled temperature laboratory at 21°C and a 16-hour photoperiod. Numbers of WFT adults and larvae per flower were assessed 2-3 days, seven and fourteen days after the first treatments.

Results and Conclusions

- At all three assessment dates, Actara significantly increased the proportion of dead WFT adults compared with the water controls, giving means of 11%, 35% and 55% kill after 2-3, 7 and 14 days respectively (Figure 1). N.B Actara was used as the positive control in this experiment but is not appropriate for growers to use for control of WFT on flowering plants as it is subject to the current EC restrictions on use of neonicotinoids i.e. it can only be applied to flowering plants in glasshouses and treated plants may not be put outside until after flowering.
- On the first assessment date 2-3 days after the first treatments, two of the products (code 200 used with or without Attracker) and the tank mix of Botanigard WP and Majestik also significantly increased the proportion of dead WFT adults compared with the water controls and both were as effective as Actara, giving means of 8, 6 and 6% kill respectively.
- Seven days after the first treatments, product 200 used with Attracker was again as effective as Actara, giving a mean of 51% kill of WFT adults. Botanigard WP with Majestik was significantly better than the water control but not as effective as Actara or product 200, giving a mean of 14% kill. Azadirachtin was equally as effective as Botanigard WP with Majestik, giving a mean of 12% kill.
- On the final assessment date 14 days after the first spray, product 200 used with Attracker was again as effective as Actara, giving a mean of 71% kill of WFT adults. The tank mix of Botanigard WP and Majestik was significantly better than the water control but not as effective as Actara or code 200 used with Attracker, giving a mean of 32% kill. Orange oil was as effective as Botanigard plus Majestik, giving a mean of 31% kill.
- Seven days after the first treatments were applied, WFT larvae were also recorded in the flowers. On this date only product 200 with Attracker led to significantly less WFT larvae per flower (mean 0.7) than in the water controls (mean 8.7). Fourteen days after the first treatments were applied, all treatments led to significantly less WFT larvae per flower (means 8.7 to 55.9) than in the water controls (mean 76.3). Again on this date, product 200 with Attracker was the most effective product with a mean of 8.7 larvae per flower.
- Overall the best performing treatment was product 200 with Attracker followed by Botanigard WP plus Majestik and these two treatments were selected for further testing in the glasshouse experiment.

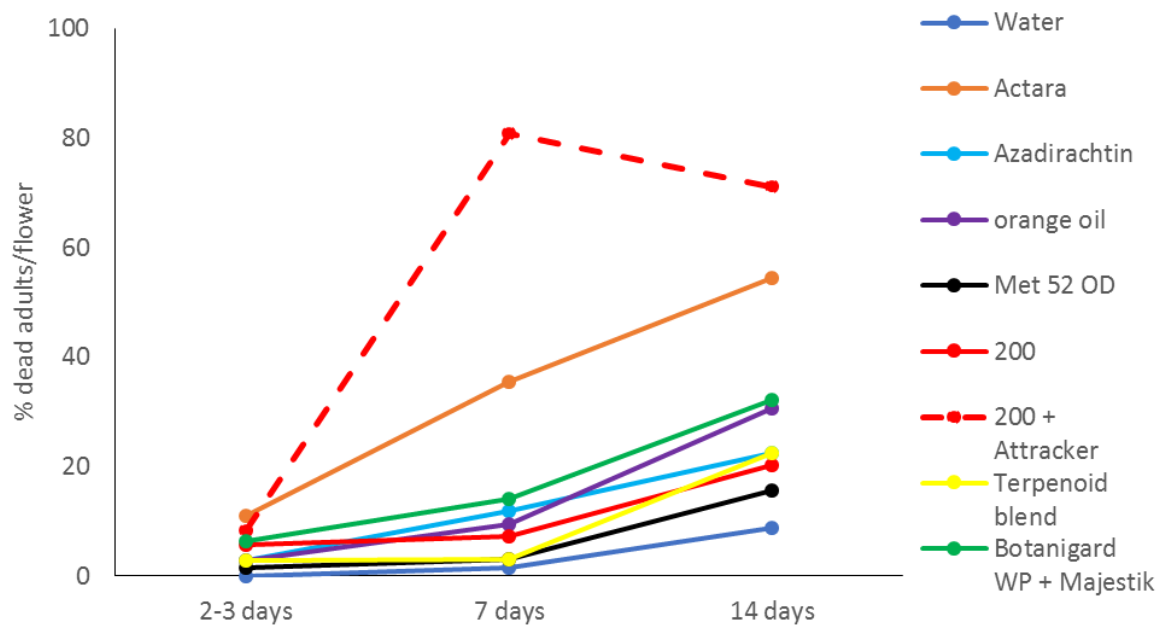

Figure 1. Mean percentage dead WFT adults 2-3, seven and 14 days after the first treatments in the laboratory experiment

Glasshouse experiment

Materials and methods

Eight treatments (Table 2) were tested against WFT on verbena plants grown in two glasshouse compartments between September and October 2016 at ADAS Boxworth. Each experimental plot was a cage (0.5 x 0.5 x 0.5 m) covered with thrips-proof mesh to avoid WFT adults flying between plots. There were six replicate plots (cages) per treatment. Temperature was regulated in the compartments by venting at 15°C and using insect-screened fans. Plants obtained as plugs were potted on into 9 cm pots on 6 August and kept in thrips-proof cages in a glasshouse until flowering. On 6 September, experimental plants were selected, choosing plants uniform in size, vigour and number of flowers. Four plants were arranged in two rows of two plants in each cage. The cages were stood on capillary matting and watered using sub-irrigation. Twenty WFT adults (18 females and two males) from the ADAS laboratory culture were released into each cage on 6 September.

Table 2. Products tested in the glasshouse experiment

MOPS code number/active ingredient	Biopesticide or conventional pesticide
Water control	-
Neoseiulus cucumeris plus water	-
Neoseiulus cucumeris plus Attracker	adjuvant
Neoseiulus cucumeris plus Actara (positive control)	conventional
Neoseiulus cucumeris plus 200	conventional
Neoseiulus cucumeris plus 200 tank mixed with Attracker	conventional plus adjuvant
Neoseiulus cucumeris plus Botanigard WP tank mixed with Majestik	biopesticides
Neoseiulus cucumeris plus Botanigard WP tank mixed with Majestik plus Attracker	biopesticides plus adjuvant

Five treatments were tested as foliar sprays as supplements to the predatory mite *Neoseiulus cucumeris*, compared with two control treatments (water foliar spray with or without *N. cucumeris*) and the standard treatment Actara. *Neoseiulius cucumeris* were released weekly to all cages except the water control cages at the standard rate of 50/m^2/week from 22 August to 28 September All spray treatments were applied to give good flower and leaf cover, just prior to run-off. . Recommended application rates were used following consultation with suppliers' technical experts. All treatments were applied using an Oxford Precision Sprayer, in 600 litres of water per hectare using 3 bar pressure. The treatments with Botanigard WP were applied using a flat fan nozzle (03F80) as recommended by the suppliers and all other treatments were applied using a hollow cone nozzle (HC/1.74/3). All treatments except those with Botanigard WP were applied at 7-day intervals on 7 and 14 September. The two treatments with Botanigard WP were applied at 5-day intervals on 7, 12 and 17 September.

Numbers of live WFT adults and larvae on all the flowers and leaves in each cage and percentage of flower and leaf damage caused by WFT were recorded one day before the first application and three, six days and 14 days after the first application. Any phytotoxicity was assessed on the same dates. An additional assessment of percentage WFT damage to flowers and the top group of leaves was made 27 days after the first application.

Results and Conclusions

- Three days after the first treatments, all treatments except for the *N. cucumeris* plus water significantly reduced numbers of WFT adults per cage on leaves compared with the water controls but all treatments significantly reduced numbers of WFT adults in flowers and numbers of larvae on leaves. Actara and product 200 with or without Attracker used to supplement *N. cucumeris* led to significantly lower mean numbers of WFT adults on leaves (0.8, 0.2 and 1.5 respectively) than when *N. cucumeris* was used with water (mean 6.7 per cage). Product 200 with Attracker used to supplement *N. cucumeris* was the only treatment that led to significantly lower mean numbers of WFT adults in flowers (mean 2 per cage) compared with when *N. cucumeris* was used with water (mean 7.7 per cage). At this assessment, none of the treatments significantly reduced percentage flower damage but all treatments except for those including Botanigard and Majestik significantly reduced percentage leaf damage compared with the water controls.
- Six days after the first treatments, all treatments significantly reduced numbers of WFT adults and larvae on both leaves and flowers per cage and reduced percentage flower and leaf damage compared with the water controls. Actara, product 200 with or without Attracker and Botanigard WP plus Majestik with or without Attracker used with *N. cucumeris* led to significantly lower mean numbers of WFT adults on leaves (1.0, 0.5, 2.2, 3.3 and 5.3 respectively) than when *N. cucumeris* was used with water (mean 10 per cage). Product 200 plus Attracker was the only treatment used to supplement *N. cucumeris* that significantly reduced percentage leaf damage (5.6%) compared with where *N. cucumeris* was used with water (19.2%).

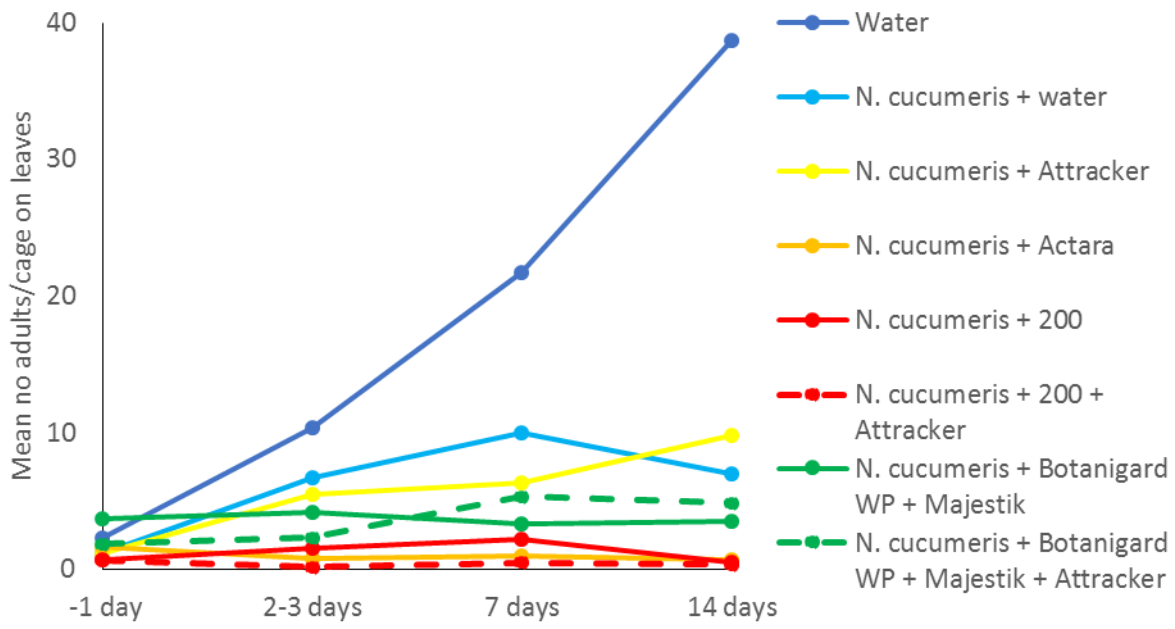

Figure 2. Mean numbers of WFT adults per cage on leaves three, six and 14 days after the first treatments in the glasshouse experiment

- Fourteen days after the first treatments, all treatments significantly reduced numbers of WFT adults and larvae on both leaves and flowers per cage and reduced percentage leaf (but not flower) damage compared with the water controls. Product 200 with or without Attracker and Botanigard WP plus Majestik used with *N. cucumeris* led to significantly lower mean numbers of WFT larvae on leaves (0.2, 1.3 and 3.5 per cage respectively) than when *N. cucumeris* was used with water (mean 20.5 per cage). Actara and product 200 with or without Attracker used with *N. cucumeris* led to significantly less leaf damage (means of 9.8%, 10.4% and 5.9%) than where *N. cucumeris* was used with water (mean 28.5%).
- At the final assessment 27 days after the first treatments, when only flower and leaf damage to the top leaves were assessed, all treatments led to significantly less flower and leaf damage than in the water controls. Actara, product 200 with or without Attracker and Botanigard WP plus Majestik used with *N. cucumeris* led to significantly less leaf (but not flower) damage (means of 4.8, 1.4, 4.2 and 12.1%) than where *N. cucumeris* was used with water (mean of 28.3%).
- Overall the most effective treatment to supplement *N. cucumeris* was product 200 with Attracker. However, product 200 without Attracker and the tank mix of Botanigard WP and Majestik also led to better WFT control on some dates than where *N. cucumeris* was used with a water control. Both these treatments were shown to integrate well with *N. cucumeris* in an IPM programme and have potential for improving WFT control.

Action points

- Although Actara showed efficacy against WFT in these experiments, only use this product on ornamental plants in a glasshouse on plants that will not be moved outside until after flowering. Actara has an EAMU for use on protected ornamentals but is subject to the current EC restrictions on the use of certain neonicotinoids (including thiamethoxam) on plants considered attractive to bees. Actara is not compatible with *Neoseiulus cucumeris*.
- If conventional insecticide 200 gains approval for use on protected ornamentals in the future, consider its use against WFT in IPM programmes as it was at least as effective as Actara and at some assessments its efficacy was improved by adding Attracker. Product 200 has translaminar action which helps to target the pest.
- Botanigard WP and Majestik are already approved so consider using the tank mix in IPM programmes together with predatory mites.