Factsheet 08/14

Soft Fruit

Managing insect pests of soft fruit crops pending spotted wing drosophila appearance

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This factsheet explains the importance of gaining early control of several important insect pests in soft fruit crops, should spotted wing drosophila become a problem.

Dealing with the challenge of pest control in the presence of SWD

Each season, soft fruit growers rely upon a range of biocontrol products to gain control of several commonly occurring insect pests. Conditions in crops protected by glass and polythene structures in particular lend themselves to successful use of many predatory insects from early in the season onwards.

The emergence of spotted wing drosophila (SWD) as a new soft fruit pest in the UK, has the potential to disrupt many of the biocontrol systems which are now being employed by growers. Commercial experience and research carried out in the USA and elsewhere has shown that the crop protection products which provide best control of SWD are likely to be harmful to the predators most commonly used. Should the timing of SWD appearance in a commercial crop coincide with population increases of two-spotted spider mite, tarsonemid mite, western flower thrips and glasshouse whitefly, then biocontrol of these pests is likely to be compromised by the use of the broad spectrum products required to control SWD.

It will be vital to implement early control strategies for these four pests to ensure that populations have been eradicated or reduced to very low levels by the time that any control measures for SWD are needed. Success will require early monitoring on a weekly basis to detect even the smallest pest populations and any early findings should be used to trigger introductions of predators at a level which will create a useful balance between pest and predator throughout the season (Figure 1).

Many growers employ soft fruit agronomists or technical staff to monitor their crops (Figure 2) for the presence of insect pests. Where two-spotted spider mite and whitefly are found early, or where western flower thrips and tarsonemid mite are known to be present, agronomists will normally recommend that biocontrol strategies be instigated early in the season. Great success in controlling each of these pests has been achieved through early introductions of predators under protection, when temperature and humidity levels are optimum for the predators to feed and breed. However, it is vital to plan ahead and order predators in advance to ensure that they are introduced at the optimum time.

1. Early introductions of predators should be made to control other pests before SWD control measures are implemented

2. Early and frequent crop monitoring for pests will be vital

If it is assumed that SWD is likely to infest soft fruit crops at some stage in the season, then early success with biocontrol will help to avoid later disruption by products used for SWD. It should also be noted that reliance on early biocontrol, where necessary, will allow traditional crop protection products to be reserved for use later, rather than using up all permitted applications at the start of the season. Examples of traditional products include Masai or Dynamec for two-spotted spider mite, Dynamec for tarsonemid mite, Tracer for western flower thrips and Majestik for whitefly.

It should also be noted that the entomopathogenic fungus *Beauveria bassiana* (Naturalis-L) provides control of two-spotted spider mite, western flower thrips and glasshouse whitefly, whilst posing no harmful effects to predators such as Phytoseiulus, Amblyseius, and Encarsia, which are used for these three specific pests. Naturalis-L may be usefully integrated with early biocontrol programmes to further reduce pest populations, should conditions not be conducive to rapid predator establishment.

Monitoring for SWD

Most UK soft fruit growers are now fully aware of the risks posed by SWD should it be found in or around soft fruit plantations. Growers are being actively encouraged to deploy monitoring traps in hedgerows, woodland and field margins to monitor for the presence of SWD. Full details about the biology of the pest, how to monitor for it and how to control it, can be found on the 'Spot it Stop it' section of the soft fruit page on the HDC website.

Crop protection products for SWD control and their impact on predators

Experience from overseas control of SWD has shown that good crop management and hygiene measures help to reduce the risk of infestation and subsequent spread of the pest. Should SWD appear in a crop, recourse will need to be made to traditional crop protection products (Figure 3), but only a limited choice is currently available to provide good control. This includes organophosphate products such as chlorpyrifos, spinosyns such as spinosad and synthetic pyrethroids such as lambda-cyhalothrin and deltamethrin. Some partial control can also be gained from abamectin, pyrethrins and neonicotinoids (eg. thiacloprid and acetamiprid).

Of these different groups of products, the organophosphates, synthetic pyrethroids, pyrethrins and abamectin, are all known to be harmful to a wide range of naturally occurring and introduced predators of soft fruit pests. As a result, their use in crops for SWD control could disrupt the establishment and development of predators or biocontrol agents which are being employed to control other insect pests.

Spinosyns such as spinosad are known to be generally safer, but can pose some mild toxicity to certain predators including Orius species and anthocorids, and can be moderately toxic to parasitoids such as Aphidius species and *Encarsia formosa*.

Neonicotinoids can be moderately harmful to *Amblyseius californicus*, *Phytoseiulus persimilis*, predatory insects such as *Aphidoletes aphidimyza*, *Feltiella acarisuga*, Orius species and anthocorids, as well as the parasitoid *Encarsia formosa*.

HDC is working very closely with the SWD Working Group and the CRD to deliver more control products to growers for use on soft and stone fruit crops. It is anticipated that some of these will be made available over the course of the 2014 season.

Whichever of these products are chosen for SWD control, biological and natural control systems being deployed for other pests will undoubtedly be compromised. Indeed, there is a risk that where crop protection products are used which have a harmful effect on predators, the populations of some pest species could actually rise in number, particularly if product application coinicides with environmental conditions which favour pest population growth.

Pests which fall into this category include two-spotted spider mite, tarsonemid mite, western flower thrips and glasshouse whitefly. Population growth of all of these pests can be slowed or restrained by naturally occurring predatory insects as well as commercially introduced ones. However, the reduction or eradication of these predators from the crop can lead to a rapid increase in the pest population. This can subsequently lead to significant crop damage and a reduction in yield of Class 1 fruit. Growers should therefore review their control systems for these pests early each season.

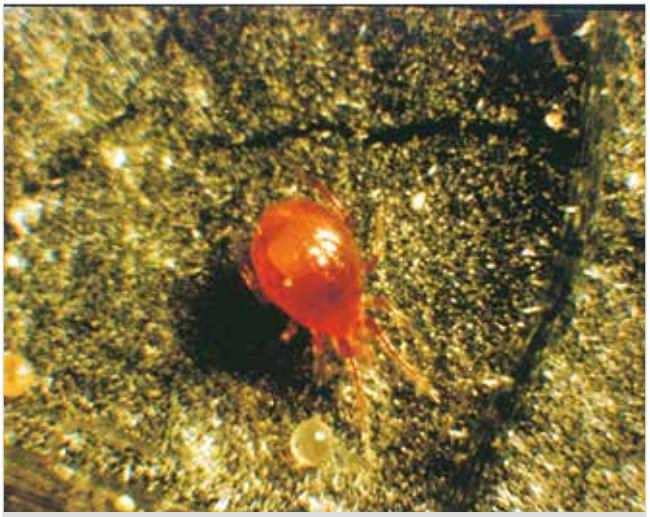
3. Should SWD appear in a crop, recourse will need to made to traditional crop protection products

Strategies for controlling these four pests early in the season

To avoid the scenario of a pest population increasing when SWD control measures are implemented, growers will need to find ways of eradicating or reducing these four pest populations to very low levels very early in the season.

Two-spotted spider mite

Soft fruit growers have had more experience using *Phytoseiulus persimilis* (Figure 4) than any other introduced predator and many achieve great success with it for controlling two-spotted spider mite. However it is commonly known that products used for SWD control are harmful to *Phytoseiulus persimilis*, an effect which can persist for some weeks after application, particularly in the case of the synthetic pyrethroids. It is therefore essential that control of two-spotted spider mite is achieved early in the season.



4. *Phytoseiulus persimils* is used to control two-spotted spider mite

This is certainly possible under protected structures when conditions and temperatures early in the season are regularly between 15-25ºC and humidity is high for part of the day, conditions which are optimum for *Phytoseiulus persimilis* to feed and breed.

- Two-spotted spider mite is so commonly found in soft fruit crops that growers should expect the pest to be present in at least very low levels each season.
- Although acaricides can be used to contain and reduce population numbers, experience shows that they never fully eradicate the pest.
- Growers should therefore expect to have to employ *Phytoseiulus persimilis* routinely at the start of each season, particularly in tunnel and glasshouse crops where temperatures are higher.
- It is wise to inspect crops very carefully on a weekly basis from early growth onwards.
- This will provide guidance on the number and frequency of *Phytoseiulus persimilis* introductions required in the early part of the season.
- Growers may also wish to use the entomopathogenic fungus Beauveria bassiana (Naturalis-L) to further reduce two-spotted spider mite populations in protected strawberry crops should the pest/predator balance be inadequate.
- This product is safe to use with *Phytoseiulus persimilis* and works best when the temperature is between 20-30ºC and the relative humidity over 60% for at least part of the day.
- For this reason, it is wise to apply it in the late evening under protection when the humidity is higher, preferably before a cloudy day.
- It is best to avoid over-venting the following day to maintain humidity.
- For greatest success, it should not be tank mixed with any other products (including fungicides) and the tank should be cleaned before using it.

Tarsonemid mite

Like two-spotted spider mite, if biological control is to be employed successfully for tarsonemid mite, then predator introduction will need to be made early in April and May, long in advance of any control measures for SWD. The most successful commercial control has often been achieved using predatory mites for tarsonemid mite. However, if complete control is not gained, recourse can be made to use of acaricides later in the season should SWD become a problem.

Many strawberry growers have experience of using *Neoseiulus cucumeris* (Figure 5) to control or prevent infestations of tarsonemid mite. It develops between 8-30ºC and relative humidity should be high for part of the day. Therefore, like *Phytoseiulus persimilis*, control can be achieved early in the season under protected structures.

5. *Neoseiulus cucumeris* is used to control tarsonemid mite

- In two year or older strawberry crops, it is essential that the crop is inspected very carefully to ascertain if the pest is present and at what level.
- This will dictate whether *Neoseiulus cucumeris* is introduced as a curative or preventive measure.
- For first year crops, where it is difficult to identify the presence of tarsonemid mite, many growers make preventive introductions early in the season using either sachets or loose product.
- Sachets can only be used in protected crops where the paper is protected from the rain.

- To gain early control of tarsonemid mite before any possible SWD control measures begin, preventive measures will be even more important.

Recent HDC funded research on biological control of tarsonemid mite using predatory mites (Project SF 133), has shown that under glasshouse conditions, *Neoseiulus californicus* (licenced for glasshouse use) offered the most effective control. *Neoseiulus cucumeris* and *Amblyseius barkeri* offered best control in polytunnel crops. The research confirmed grower experience that tarsonemid mite is extremely difficult to control once populations have become established, so growers are encouraged to introduce predatory mites early before tarsonemid populations build up. Where numbers are considered to be significant, curative introductions should be made through more than one release.

Another recent HDC project (SF 125) which assessed the efficacy of currently approved acaricides for tarsonemid mite control, showed that Dynamec plus the wetter Silwet L77, applied in high volumes of water to penetrate the crown tissue, provided the most effective control.

- Should growers fail to gain adequate control of tarsonemid mite early in the season, before SWD control measures are required, use of Dynamec offers another control option.
- However, as described earlier, abamectin (Dynamec) is harmful to other predators.

Western flower thrips

In the soft fruit industry, this pest is currently proving to be the most difficult to control. Despite HDC funding a number of research projects on western flower thrips (WFT) in strawberry crops, no single, easy and completely effective control method has been uncovered and it remains a high priority for HDC to fund further research. A number of approaches to control are currently being investigated in Defra Horticulture LINK project HL01107 (HDC Project SF 120), including the development of a pheromone based monitoring trap, a computer model to predict pest populations and forecast risk, new selective pesticide treatments and novel strategies for biological control agents.

Given that the currently available crop protection products are not offering adequate control in some areas and some crops, growers should resort to the use of biocontrol. This needs to be implemented early in the season before SWD control measures are required.

- In the Defra Horticulture LINK project, *Neoseiulus cucumeris* was used to control WFT.
- Best results were achieved when it was introduced in reasonable numbers from sachets when temperatures were above 13ºC (mid-March under tunnels in the year of the experiment).
- Further work showed that early releases of *N. cucumeris* from sachets followed by more of either sachets or loose product after six weeks, can reduce numbers of western flower thrips in the crop.
- However, numbers of the pest may still increase later in the season.
- Introductions of *Orius laevigatus* (Figure 6) in combination with *N. cucumeris* can control all life stages of thrips in the warmer months from late May and June onwards.
- *Orius laevigatus* needs a minimum of 15ºC for egg laying.

6. *Orius laevigatus* can be used to supplement *Neoseiulus cucumeris* in controlling western flower thrips

- Growers may also wish to use the entomopathogenic fungus *Beauveria bassiana* (Naturalis-L) to further reduce western flower thrips populations in protected strawberry crops should the pest/predator balance be inadequate.
- It will offer partial control of the adult and larval stages of the pest.
- This product is safe to use with Amblyseius, Neoseiulus and Orius species and works best when the temperature is between 20-30ºC and the relative humidity over 60% for at least part of the day.
- For this reason, it is wise to apply it in the late evening under protection when the humidity is higher, preferably before a cloudy day.
- It is best to avoid over-venting the following day to maintain humidity.
- For greatest success, it should not be tank mixed with any other products (including fungicides) and the tank should be cleaned before using it.

Glasshouse whitefly

Whitefly tends to be a bigger problem in glasshouse crops than polythene tunnel or unprotected crops. The higher average temperatures and higher humidity that prevail under glass are ideal for whitefly development. The principal control agent for whitefly is the parasitic wasp *Encarsia formosa*, which needs higher temperatures than the whitefly. *Encarsia formosa* is adversely affected by almost all of the crop protection products used for SWD control. It is therefore essential that it is used to gain control of whitefly well in advance of the use of SWD control agents.

- It is best to start introducing *Encarsia formosa* every week from the start of crop growth in the spring.
- Temperatures need to be 18ºC for a few hours each day for the wasp to be effective.
- The rate of introduction will depend on existing levels of infestation, ranging from 1 black scale per m^2 as a preventive measure to 10 per m^2 for severe infestations (Figure 7).

7. Black parasitized and white whitefly scales

- Growers may also wish to use the entomopathogenic fungus *Beauveria bassiana* (Naturalis-L) to further reduce whitefly populations in protected strawberry crops should the pest/predator balance be inadequate.
- It offers control of adult and larval stages of whitefly species. This product is safe to use with *Encarsia formosa* and works best when the temperature is between 20-30ºC and the relative humidity over 60%.
- For this reason, it is wise to apply it in the late evening under protection when the humidity is higher, preferably before a cloudy day.
- It is best to avoid over-venting the following day to maintain humidity. It should not be tank mixed with any other products (including fungicides) and the tank should be cleaned before using it.

Managing predators in soft fruit crops

For all of the predators discussed with each of these four pests, it is essential that farm staff are trained to handle and care for the predators when they are delivered to the farm and how to introduce them to the crops for best effect.

Full information is included in the HDC soft fruit grower guide *Bicontrol in soft fruit* and training videos are available for farm staff to watch on the HDC website www.hdc.org.uk/biocontrol-videos.

Further useful information

The HDC grower guide 'Biocontrol in soft fruit' provides comprehensive guidance and information on all of the pests discussed above and the best methods of controlling each using biocontrol agents.

Comprehensive information about spotted wing drosophila is found on the soft fruit page of the HDC website, under the heading 'Spot it Stop it'.

Growers should also seek guidance on the best strategies for controlling these pests with SWD in mind, by consulting a BASIS qualified agronomist.

A full list of useful references worth consulting is found below:

HDC website

SWD page dedicated to information on spotted wing drosophila: www.hdc.org.uk/swd

HDC grower guide

Biocontrol in soft fruit

HDC factsheets

HDC Factsheet 05/03 Integrated control of thrips on strawberries

HDC Factsheet 15/03 Tarsonemid mite on strawberry

HDC Factsheet 13/11 Pesticide residue reduction in commercial raspberry crops

HDC Factsheet 10/12 Midge, mite and caterpillar pests of cane fruit crops

HDC Factsheet 13/13 Reducing residues in strawberries through novel crop protection methods

HDC Project reports

SF 74 – Integrated pest and disease management for high quality protected raspberry production (Defra Horticulture LINK HL0175)

SF 79 – Evaluation of foliar sprays of acaricides for control of tarsonemid mite in strawberry

SF 80 – Tunnel-grown everbearer strawberry: biology and integrated control of western flower thrips

SF 90 – Chemical control of western flower thrips in strawberry flowers

SF 94 – Minimising pesticide residues in strawberry through integrated pest, disease and environmental crop management (Defra Horticulture LINK HL0191)

SF 120 – Biological, semiochemical and selective chemical management methods for insecticide resistant western flower thrips on protected strawberry (Defra Horticulture LINK HL01107)

SF 125 – Evaluation of acaricides and adjuvants for strawberry tarsonemid mite control

SF 133 – Optimising tarsonemid control on strawberry using predatory mites

Availability

All of these publications and project reports are available on the HDC website. Paper copies of each can be ordered from HDC by contacting Louise Arculus on 024 7647 8661 or at louise.arculus@hdc.ahdb.org.uk.

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