Spotted Wing Drosophilla *(Drospohila Suzukii)* SWD
Code of practice for soft fruit growers

Figure 1. A 'Drosotrap' in situ. This is one example of the monitoring traps available.

Figure 2. Adult male spotted wing drosophila (SWD)

The best approach to managing this pest is an integrated solution of excellent crop husbandry, crop monitoring, early control, excellent sanitation and disposal of fruit waste.

Action points:

- Monitor from March using Drosotraps (Figure 1.), particularly in hedgerows. The trap contents should be monitored weekly. The liquid bait should be topped up each time.
- Consider the use of ‘mass trapping’ for very high risk crops.
- For soft fruit crops, two traps per hectare should be erected at blossom time.
- For cherry and other stone fruit crops, two drosotraps per hectare should be used. Place these within the crop about 10 metres inside the perimeter and at early leaf stage.
- Once fruit begins to ripen use the flotation test every week to check for the presence of larvae in developing fruits. It is recommended to do this at every pick on a representative fruit sample.
- From early fruit ripening, if SWD populations are present in the crop, use recommended control products according to good agricultural practice.
- During harvest, maintain strict hygiene measures. Ensure the removal of every ripe fruit from the crop. This includes all damaged, diseased and overripe fruit and any fruit that has fallen on the ground.
- All waste fruit and any affected by SWD should be enclosed for at least 48 hours at 14°C in a sealed plastic bin to kill all larvae. Leave longer if temperatures are lower.
- All fruit waste will attract SWD therefore it should be incorporated into the soil.

Figure 3. Adult male are distinguished by their spotted wings and sex combs on the forelegs.

Identifying SWD

There are some characteristic differences between SWD and its fruit fly relative (*Drosophila melanogaster*). The males have a large spot along the front edge of each wing (Figure 2). It also has two dark dark sex combs on the forelegs (Figure 3). The female can be recognised by its unusual serrated ovipositor (Figure 4.). This allows it to puncture the skin of fruit.

Crop damage: Damage is caused by the adult female. Her serrated ovipositor allows her to puncture fruit and lay her eggs underneath. When the eggs hatch, the resulting larvae contaminate and feed on the fruit flesh. This damage causes economic losses.

Crops of concern: Current evidence suggests the pest has a preference for crops of cherries, raspberries (floricane & primocane), blackberries and blueberries. Both

June bearer (short day) and ever-bearer (long day & day neutral) cultivars are also at risk, with ever-bearer crops more high risk. Many wild fruit crops and trees growing in our hedgerows also act as hosts for SWD. This would include: wild blackberry, elderberry, hawthorn, honeysuckle, wild raspberry, wild cherry for example. Many fruit bearing garden plants are also likely to act as hosts.

Life cycle: SWD can have many generations per year. (up to 13 per year in Japan). This is temperature dependent. It can take between 12 and 79 days to develop from egg to adult. The higher the temperature the faster the development and reproduction rate. Females can lay over 300 eggs in a life time and are active from approximately 10°C. Eggs are laid any time between spring and autumn.

Figure 4. The adult female is distinguished by the serrated ovipositor at the rear of the abdomen.

Monitoring for adults

There are a number of commercial traps available (e.g.Agralan, Biobest, Koppert etc.). The Biobest 'Drosotrap' (Figure 1.) is one such trap. The traps need to be filled with a liquid bait these, which are available from the same companies. Smaller traps

are also available and these are more suited to mass trapping. They are generally placed every 2 metres around the perimeter of the crop

When to monitor Ideally 12 months of the year to monitor increasing or decreasing population levels. From March set traps out at 2 per hectare on the perimeter of the crop. As soon as populations are being caught in the hedgerows start monitoring in the crops. The exception is cherry which is known to attract adult SWD into the crop earlier. Traps should be set out in these crops from early leaf onwards

Locating monitoring traps In hedgerows traps should be hung one metre above ground level and out of direct sunlight. Within the crop place two traps in the shadier part of the crop. In cane fruit, bush fruit and stone fruit hang the trap at one third of the canopy height. In tunnel and glasshouse grown strawberry crops hang 10cm above leaf canopy.

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Figure 5. Another example of a SWD trap. This trap is placed within a strawberry crop.

How to use the traps

The Biobest Drosotrap will be used here as an example. Fill the trap with approximately 300 ml of liquid bait. The trap should be checked weekly for SWD catches. Decant the liquid bait through a funnel of fine mesh filter paper into a collecting container. The spent liquid should not be poured on to the ground as it will continue to attract SWD. The filter paper should be placed in a collection tube and sent to the laboratory for analysis. If the sample cannot be posted immediately it should be placed in a freezer. Do not post samples to the laboratory on a Friday. Don't forget to refill the trap with liquid bait.

Monitoring for Larvae

The quickest way to determine if SWD larvae are present in fruit is through a flotation test. A sugar solution is used to extract existing larvae from the fruit (Figure 6).

- Make a sugar solution by dissolving 1kg of sugar in 5.5 litres of water.

- Place 100g of ripe or semi ripe fruit sliced fruit in a small clear polythene bag. Very gently crush the fruit.
- Add the sugar solution to the bag, with enough solution to cover the fruit. Seal the bag with a tie
- Leave for 10 minutes and then mix the fruit a little more with the solution.
- After another short while you should be able to see the larvae (white lines 1-4mm in length) in the solution if they are present.

Figure 6. Flotation test releases larvae from the fruit into solution, making them visible to the naked eye.

When to monitor for larvae in fruit

It is important to monitor for the presence of larvae in fruit both before and during harvest. Detecting an issue early allows control measures to be implemented before the next harvest. Sampling fruit in the lead up to harvest:

- Sample weekly from all plantations as fruit begins to colour.
- Select more than 100 ripening fruits from across the crop

- Include fruits from the edges of plantations near hedgerows

Sampling fruit during the harvest:

- Take a sample from each crop, in each field and each picking time.

Crop management and hygiene – prevention is better than cure

Scrupulous crop management including meticulous hygiene and correct disposal of fruit waste is paramount.

Meticulous hygiene All fruit should be harvested as frequently as possible. This will leave fruit less vulnerable to attack by the adult SWD. All unmarketable fruit must be removed from the plant (e.g. misshapen, overripe or diseased fruit) All fruit that has fallen on to the ground must be removed at picking.No unmarketable fruit should be left sitting in punnets/trays or unsealed bins anywhere on the farm. Transport fruit to cold store as soon as possible. Lowering the cold store temperature as low as possible (e.g. ≥ 1° C) will reduce the speed of larval growth. Ideally, if there is other fruit or feed stuff wastes on the farm apply the same sanitation measures as for the soft fruit.

Figure 7. It is essential that fruit waste undergoes anaerobic treatment to kill SWD larvae and pupae within the fruit.

Containment and disposal:

Fermentation of fruit in a sealed container. The AHDB (UK) have investigated the fermentation of fruit in sealed containers. The container is filled with fruit waste to

within 10cm of the lid. The lid was sealed with tape and a valve fitted to allow excess gas to escape. All SWD larvae had died within 2 weeks of sealing. The waste separated into a 90% liquid and a 10% solid surface. This material must be disposed of. Burying it is the current recommendation.

The most important aspect is that the lid is very tightly sealed after placing the fruit into it. When the bin is full it should be sealed tightly. Any SWD larva if present will die from lack of oxygen within 48 hours. This waste can then be safely disposed of. Freezing, cooking, drying and anaerobic digestion are other methods which will kill the egg or larva in fruit. (Figure 7)

Ventilation and water management: This pest likes high humidity. It is recommended to ventilate all protective structures as much as possible. The pest also breeds faster near water. Therefore it is best to avoid the use of overhead irrigation, fix any leaking irrigation pipes and avoid the pooling of water near the crop.

Use of crop protection products: As of print there is a very limited range of pesticides approved for the control of SWD. This is why the control methods outlined above are critical. We are in the process of seeking a number of new control products for the 2018 season. We will update growers when these are approved.

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Photos and supplemental information courtesy of the Agricultural and Horticultural Development Board (AHDB), UK.

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