FACTSHEET 19/16

Cross Sector

(Project SF 145)
Ralph Noble and Andreja Dobrovin-Pennington,
NIAB EMR

Disposing of fruit waste affected by spotted wing drosophila

Fruit affected by spotted wing drosophila (SWD) is unmarketable and must be disposed of as waste during and after the harvest operation. Inadequate disposal perpetuates populations of SWD in soft and stone fruit crops. This factsheet outlines the best practices to follow when disposing of this waste, to reduce populations of SWD to a minimum.

Figure 1. Waste fruit should be disposed of in plastic bins with a capacity of 500–670 litres

Action points

- All waste fruit should be removed from soft and stone fruit crops both during and after harvest to reduce the risk of SWD damage
- Waste fruit should be disposed of in sealed plastic pallet bins with a capacity of between 500 and 670 litres (figure 1)
- A combination of depleted O_2 and high CO_2 concentration is needed to kill SWD in the waste
- Treatment of soft fruit waste in sealed bins for two days at waste temperatures of at least 18°C will ensure eradication of SWD. If waste temperatures are below 18°C, three days are required
- There can be a low level of survival of SWD (5% of the original population) in stone fruit waste treated for three days, particularly if the waste temperature is below 16°C. A four-day treatment should be used for stone fruit
- Rotavation of treated waste into soil to a depth of 20cm is a suitable disposal route. The rate of application of treated waste to land should not exceed 125 tonnes/ha
- Mixing the treated waste with at least 90% w/w with other organic waste is a suitable disposal route
- The availability and gate-fee cost of large-scale composting and anaerobic digestion facilities in the vicinity should be explored as an alternative disposal method for fruit waste.

Introduction

If managed incorrectly, SWD can lead to crop losses and fruit waste in soft and stone fruit crops. SWD is attracted to under-ripe, ripe and overripe fruits, so it is vitally important to remove any damaged, diseased and overripe fruits that were often traditionally left in the field, as they are still attractive to SWD. It is also essential to remove old and waste fruit (which may have fallen to the ground – figure 2), to prevent further SWD population build up in a plantation.

The form of disposal is crucial, however. Discarding any reject or waste fruit on open heaps must be avoided, as this allows SWD to reproduce, feed and overwinter (females in reproductive diapause). Rapid composting would be ideal but the sufficiently high temperatures required to kill SWD can be difficult to achieve in fruit due to its very high moisture content. Freezing of waste can be an effective alternative to kill SWD but it is often impractical to dispose of large quantities of frozen waste.

One practical solution is to utilise the oxygen demand and carbon dioxide produced by fermenting fruit waste in sealed bins to kill SWD, similar to the techniques used for controlling insect pests in store.

Figure 2. Fruit waste left on the orchard floor can attract SWD adults

Collection of fruit waste

Waste fruit (old, damaged, diseased and misshapen) should be removed from the field, preferably at every pick. It may be possible to mechanise the collection of fallen fruit in orchard crops such as plums and cherries. Collection and disposal of fruit waste in polythene bin liners is impractical, as the bags can be opened by wild animals and will eventually split or burst due to the fermentation of the fruit waste (figure 3). Waste fruit from the picking and packing operations can be collected in plastic pallet bins positioned next to the cropping or packing areas and transported to a suitable treatment area. Alternatively, waste can be collected in covered bins that are frequently emptied or in 30 to 50 litre sealable plastic vessels and kept at ambient temperature for up to two days or at 4°C for up to 10 days, before emptying into pallet bins.

Figure 3. Plastic bin liners are unsuitable for waste disposal

Figure 4. Plastic pallet bins of between 500 and 670 litres are ideal for disposing of fruit waste

Figure 5. Filling, emptying and handling plastic barrels can be more difficult than plastic pallet bins

Treatment of fruit waste in sealed bins

The most suitable plastic pallet bins have a capacity of between 500 and 670 litres (figure 4). Although 1,400 litre pallet bins or 200 litre plastic barrels with sealable lids (figure 5) can also be used, filling, emptying and handling these is more difficult. Larger sealed plastic vessels with capacities up to 10 cubic metres have also been used successfully, although this requires an extraction hose for emptying the vessel and some water needs to be added to the waste to make it flow.

If using pallet bins, fruit waste should be filled to within 10cm of the top. The top edge of the pallet bin is covered with a layer of polyethylene black stretch shrink wrap (about 50cm wide x 25 micron thick – figure 6a). A single layer of black shrink wrap is then attached to this to seal the top of the bin (figure 6b). The plastic bin lid is then positioned (figure 6c) and sealed to the sides of the bin with a further layer of shrink wrap (figure 6d).

In AHDB Project SF 145, 'Understanding and developing methods for managing spotted wing drosophila (SWD) in the UK: Vital research to maintain the viability of the UK fruit industry', the procedure was tested with batches of soft and stone fruit waste to determine the length of time needed to eradicate SWD from the waste.

The oxygen and carbon dioxide concentrations in the headspace air in the bin were also recorded. During the testing, eggs, larvae and pupae of SWD or *Drosophila melanogaster* (the common UK fruit fly) or both, were introduced to the batches of pallets of fruit waste. The pallets were sealed for periods of between one hour and 13 days, before and after which samples of fruit waste were tested for the emergence of adult *Drosophila* species. The tests were conducted both in warmer summer conditions (fruit waste at 18–25ºC) and in cooler conditions (fruit waste 14–16ºC).

Figure 6a. Covering the top edge of the pallet with polyethylene shrink wrap

Figure 6b. Sealing the top of the bin with shrink wrap

Figure 6c. Positioning the lid on the top of the pallet

Figure 6d. The lid is sealed to the sides of the bin with a further layer of shrink wrap

Results

Oxygen concentration in the headspace of the bins rapidly became depleted and was not detectable in any of the soft or stone fruit batches after six hours. In soft fruit at 18–25ºC, there was a corresponding increase in CO_2 concentration, that exceeded 20% v/v within six hours and reached 80% v/v within 24 hours. In some of the stone fruit batches at 14–16ºC, three days were required to reach 80% v/v CO_2. Ambient air temperatures were 2–5°C lower than those recorded in the batches of waste.

Adult *D. melanogaster* subsequently emerged from all untreated fruit waste samples, and from soft fruit samples taken from bins treated for up to 24 hours after the bins were sealed. A small proportion of adults (about 5% of the numbers emerging from untreated waste), emerged from stone fruit waste treated for three days.

The results for emergence of SWD adults from treated fruit wastes were similar to those for *D. melanogaster*. No adult SWD emerged from soft fruit waste treated in sealed bins for two days at 18–25ºC, but two adult SWD emerged from stone fruit waste treated for two days at 14–16ºC, compared with 75 adults emerging from untreated waste. The higher risk of SWD survival in batches of stone fruit waste, particularly at lower temperatures, may be explained by the greater stability of the waste and slower increase in CO_2 concentration than in soft fruit waste.

Disposal of treated fruit waste

Following treatment in sealed pallet bins, although the number of emerging SWD will be eliminated or reduced to a very low level, the waste remains attractive to egg-laying SWD adult females, and retains the potential to rear a complete SWD life cycle. The treated waste must therefore be disposed of so that it is no longer attractive to breeding SWD.

Treated fruit waste should be spread onto bare soil and then incorporated to a depth of 20cm with a tractor-mounted rotavator. The waste then rapidly degrades in the soil and, to date, no SWD have been observed in the treated areas of fields. The maximum amount of organic waste that can be applied to land is restricted by the EU Nitrates Directive in Nitrate Vulnerable Zones (NVZs) to an equivalent of 250kg N/ha. Fruit wastes contain about 0.2% N fresh weight, allowing up to 125 tonnes of fruit waste to be applied per hectare each season. This must not be done during the ‘closed season’ for land-spreading (October to March) and a record must be kept of the amount of waste applied.

Other disposal methods for treated fruit waste include mixing with organic wastes in a concreted bay. The quantity of fruit waste in the mix should not exceed 10% w/w. Treated fruit waste can also be covered with a 20cm layer of soil or spent grow bag substrate and composted until it is no longer attractive to SWD (this duration has not been established). Before land spreading and incorporation, the quantity of stored waste should not exceed 50 tonnes/ha. Any run-off should be collected and not allowed to contaminate water courses.

Other disposal options for fruit rejects and waste

If there are large-scale composting or anaerobic digestion facilities in the vicinity of fruit production, they may accept fruit waste. The economics of these disposal routes will depend on the value or gate-fee for the fruit, and on the distance to the processing facility. However, before dispatch, secure storage of the waste must be considered so that it is not attractive to SWD and does not create an SWD risk.

Further information

Further information on the research undertaken on disposal of waste fruit in Project SF 145, 'Understanding and developing methods for managing spotted wing drosophila (SWD) in the UK: Vital research to maintain the viability of the UK fruit industry', is available from the scientists leading the work:

Ralph Noble, NIAB EMR
(ralph.noble@emr.ac.uk)

Andreja Dobrovin-Pennington, NIAB EMR
(andreja.dobrovin-pennington@emr.ac.uk)

Want to know more?

If you want more information about AHDB Horticulture, or are interested in joining our associate scheme, you can contact us in the following ways...

horticulture.ahdb.org.uk

AHDB Horticulture, Stoneleigh Park,
Kenilworth, Warwickshire CV8 2TL

T: 024 7669 2051 E: hort.info@ahdb.org.uk

@AHDB_Hort

AHDB HORTICULTURE

AHDB Horticulture is a part of the Agriculture and Horticulture Development Board (AHDB).

£8.75
where sold

HT70370616