KIWIFRUIT GROWERS' BMSB PREPAREDNESS

What you need to know about long-term management of BMSB

Ko Tātou This Is Us
BIOSECURITY 2025

KVH
KIWIFRUITVINEHEALTH

PURPOSE OF THIS GUIDE

This guide has been produced to inform growers and the kiwifruit industry of the likely options for on-orchard management of Brown Marmorated Stink Bug (BMSB) should it establish here, and is based on current research findings subject to change as knowledge advances.

The initial response will be managed by Biosecurity New Zealand, with shared decision making by the BMSB Council, of which KVH is a member, and development of response plans will sit separate to this on-orchard guide.

If the BMSB Council determines that it is no longer feasible to eradicate of contain the pest because of rapidly increasing population sizes and/or wide spread establishment, the response will likely transition to Long Term Management which is where this guide should be applied. This guide outlines all the things you as a grower should do on-orchard and how to do them when managing BMSB long-term.

BMSB DISTRIBUTION

BMSB is a hitchhiker pest which continues to spread globally through movement of containers, vehicles, machinery and people.

It is native to Asia and found across three major continents (North America, Europe, and Asia). It invaded the US in the 1990's (and has also been found in Canada), and is rapidly spreading through Europe, particularly Italy and Georgia where significant damage to horticultural crops has been reported.

BMSB has been found in Santiago, Chile, the first population in the Southern Hemisphere. This potentially increases the risk to New Zealand given our seasonal alignment, which makes establishment easier for any bugs arriving.

The BMSB can be identified by black and white banding on the antennae and it's larger size - about the same as a 10c coin.

Black and white alternate banding on the sides of the abdomen are a distinguishing feature.

WHAT TO LOOK OUT FOR

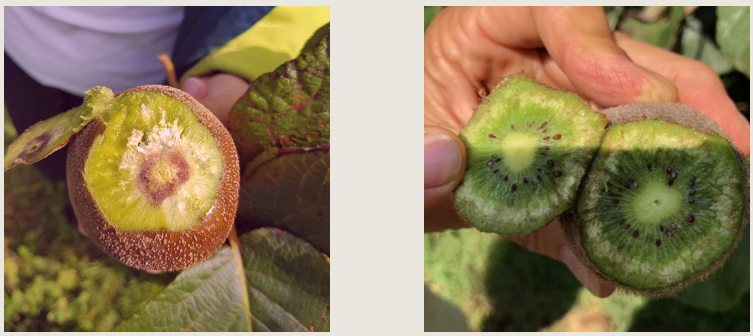
BMSB has a wide host range of over 300 plants, including kiwifruit.

Adults and nymphs affect fruit quality by sucking sap from leaders, young leaves, shoots and fruit. The affected leaves often have yellow-green spots and may cause flower or bud drop at the early stage. Injured parts of ripe fruit turn white and spongy, and eventually rot.

LIKELY IMPACTS

International reports and observations suggest that if BMSB were to arrive in New Zealand, we could expect:

- 5-10% fruit loss on both green and gold orchards, but could be 30% or higher on the most affected blocks from fruit drop and storage rot
- damage to both green and gold varieties. Lab trials show no preference between the two although gold may be easier to observe both as a feeding wound and because it tends to result in fruit drop
- increased packing and Quality Assurance (QA) costs to prevent storage rot
- increased operational costs from insecticide use, netting, and labour
- insecticide use may create challenges to operate within Maximum Residue Limits (MRLs); could disrupt Integrated Pest Management (IPM) programmes; and cause secondary pest outbreaks
- BMSB is not a kiwifruit specific issue and there would be impacts to a wide range of crops and native species. We would require an area-wide management approach for effective control.

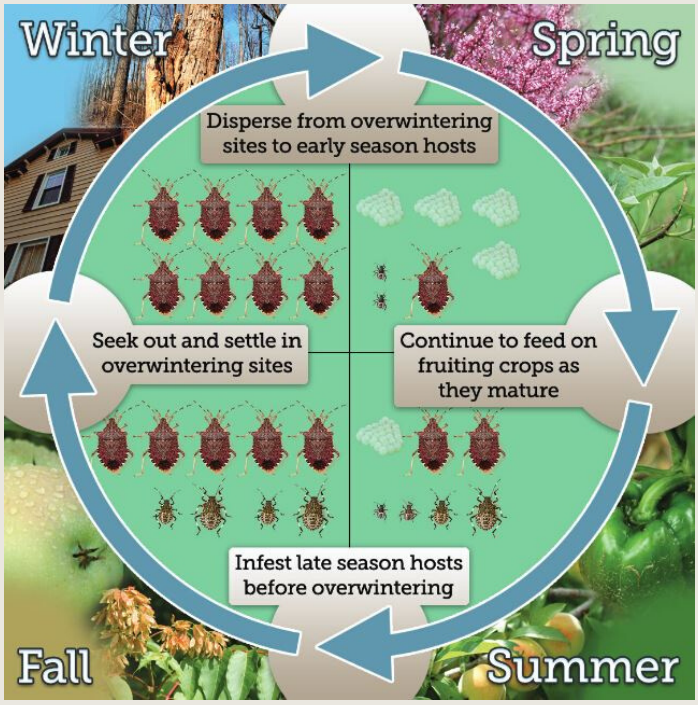


BMSB damage to Gold3 (left); damage to Hayward (right).

TIMING

Knowing when orchard impacts are likely to occur helps us time interventions for maximum effectiveness:

- BMSB overwinter in inanimate objects or in the seams of many trees. In New Zealand, this might include shelter belts, gullies and people's houses.
- In spring, as temperatures increase, they start to move into trees/crops and begin inflicting damage. We may see BMSB on kiwifruit orchards as early as October (around pollination time).
- Eggs are deposited in early summer (this is when the Samurai Wasp will be most effective).
- Nymphs begin emerging about a week after egg deposition and gradually move further from the eggs as they develop into adults, typically in late summer (February).



ON-ORCHARD MANAGEMENT

If evidence of a BMSB breeding population is detected in New Zealand there will be a response with the aim of eradication. This will be managed by Biosecurity New Zealand and the BMSB Council of industry representatives - of which KVH is a member - with shared decision making by industry under the Government Industry Agreement for Biosecurity Readiness and Response (GIA) partnership.

Control options during such a response will likely be a combination of chemical and biological controls. Any action taken to eradicate or contain BMSB (that results in a financial loss) in a response under direction by Biosecurity New Zealand would be eligible for compensation under the Biosecurity Act. These must be verifiable so good record keeping is essential.

If eradication is not achieved, then control of BMSB will likely move to long-term management where the objective is to minimise the impact of this pest.

In the US and parts of Europe, chemical control has been the most widely used strategy for managing BMSB damage. For New Zealand, chemicals are likely to play an important role in an initial response, however are not a viable option for long-term management on kiwifruit orchards, given that effective chemical control of this pest cannot currently be achieved post flowering at rates within our residue requirements. In New Zealand we will require more sustainable cultural or biological approaches which are likely to include a combination of the following:

- exclusion netting
- biological control agent to suppress populations, such as the Samurai Wasp
- traps for monitoring (to help timely interventions)
- attract and kill strategies
- application of biopesticides and other soft spray options.

Exclusion netting in Italy (top) and over head netting on a new orchard in New Zealand (bottom).

PRIMARY CONTROL TOOLS

Exclusion Netting

- Exclusion mesh is a readily available tool for crop protection and a residue friendly option that avoids the use of insecticides.
- Mesh size is critical as enclosed netting can affect the microclimate ecosystem. Ideally, netting needs to be small enough to keep BMSB out (adults at least), but at the same time, large enough to allow for most beneficial insects to pass through.
- In Italy, anti-hail nets of 2.4x4.8mm mesh size are proven to reduce damage in kiwifruit, and with the sides down, manages BMSB.
- In cases where the need to keep out large numbers of BMSB is significantly higher, finer meshes (1.5mm) are appropriate as the smaller size excludes all life stages.
- Exclusion netting is stitched into anti-hail netting to create walls and fully enclose orchards (this needs to occur pre-pollination in order to be effective).

Knowledge gaps to be addressed by current and future research

- Understanding of secondary effects of netting on other pest populations.
- Effects on crop quality and production with use of hail netting as exclusion.
- Impacts on pollination and best pollination practices.

Chemical control

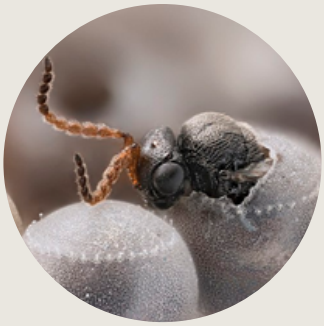
- BMSB pest pressure is highest at orchard borders so targeted spraying of shelter belts and boundaries may be most effective but growers must strictly adhere to the Zespri Crop Protection Standard.
- Targeting overwintering sites and surrounding areas outside orchards will help prevent large spring infestations.
- Freshly applied insecticide (weekly applications) likely required for population control in high densities.
- Bifenthrin (Talstar) has been identified as an effective product which is registered for use in New Zealand, however it is not compatible with biocontrol and has strict controls around use rate and period for kiwifruit. As such, timing with biological controls needs to be carefully considered for effective control.

Knowledge gaps to be addressed by current and future research

- Better understanding about whether effective control can be achieved with lower rates of Bifenthrin.
- What are the most effective alternatives to safeguard against loss of a single tool?

Biological control - Samurai Wasp

- In August 2018, EPA approval was granted for the release of the Samurai Wasp should BMSB become established in New Zealand.
- Is a natural enemy of the BMSB and can provide ongoing population suppression. Extremely effective in seeking out BMSB egg rafts - in its native range is capable of parasitizing up to 80%.
- Likely to be an effective long-term tool but could also be used with eradication efforts by flooding a BMSB detection with wasps.



A Samurai Wasp (the size of a poppy seed) making its way out of a BMSB egg.

Knowledge gaps to be addressed by current and future research

- Sourcing the Samurai Wasp in sufficient numbers in a timely manner.
- Informing an eradication release plan (the number of wasps required, frequency and timing of release by select approved parties, effective searching range, impact of previous spray applications on wasp mortality).

ON-ORCHARD SUPPORTING TOOLS

BMSB does not reside permanently in any crop - it invades from the outside and pressure is often highest along orchard edges. As such, fruit damage is most severe on block perimeters. This is where monitoring efforts should be focused, including periodically inspecting sampled fruit for internal injury. BMSB can be hard to see in the orchard and damaged fruit can be a good indicator.

MONITORING TOOLS

1.Sticky traps

- Sticky traps baited with a commercial pheromone lure (Trece® Inc.) are commonly used as an effective monitoring tool.
- Traps, with lures attached above, are placed about 2m off the ground on preferred host trees using staples, cable ties or hung off nails.
- Spacing of 120m between traps works best. These should be checked weekly.
- Traps should be changed every 6 weeks and lures 12 weekly.
- Sticky cards are thought to capture around 5% of BMSB populations because the lure is based off the BMSB aggregation pheromone and not a sex pheromone (such as that used for fruit fly). Careful checking of flora in a 5m radius of the trap will result in a much higher catch rate.
- These traps are used to monitor populations and inform other management practices, for example, In the US more than 10 BMSB on a sticky trap will trigger insecticide treatment.
- There is a BMSB surveillance and trapping programme in the Bay of Plenty (which is part of a larger national programme), co-funded by Zespri and KVH. Traps are monitored fortnightly at 10 locations running from the Port of Tauranga in Mount Maunganui to Whakatane, concentrated around high-risk sites.

Clear sticky trap coupled with pheromone lure attached above (left). Vegetation beating to check flora around sticky traps for bugs in Mount Maunganui December 2018.

2.Light traps

- Light traps can be inexpensive, quick and simple to make. They can simply be a light source leading into a trap, such as soapy water.
- Research shows white, blue and ultraviolet light traps are the most attractive to BMSB.
- A combination of different types of traps can provide season round monitoring and give us the best chance of detecting an incursion early.
- Pheromone traps are most effective in spring and autumn and not as effective over summer when BMSB are most active. Therefore, during the summer, light traps will be most effective at monitoring populations.

Before and after: all you need to make a light trap (left); completed home-made light trap (right).

ATTRACT AND KILL

The theory behind attract and kill is to lure a pest (such as BMSB) to a location and kill it there. This strategy avoides the need to spray or treat large areas, thus significantly reducing spray use, saving labour costs and environmental side-effects such as secondary pest outbreaks. This is a current focus area of research efforts.

1.Ghost nets

- Ghost nets are normally free-standing but can be hung in trees. They are soaked with insecticide and baited with an aggregation pheromone.
- Have shown promise for BMSB control by exploiting the aggregation pheromone response, resulting in extending periods of contact on the net, therefore increasing exposure to the insecticide.
- Benefits include limiting insecticide use across large areas and are compatible with biological control.

Example of a ghost net.

- Could also be used in an urban setting where large scale spraying would not be achievable.
- Alone, these traps are unlikely to provide control at levels required for local eradication, however they are valuable for monitoring and crop damage reduction provided they are not placed too close to the crop.

Example of a ghost net.

Knowledge gaps to be addressed by current and future research

- Looking at deployment methods and secondary insecticidal effects (non target/pollinators). Improving this approach is a research focus.
- Understanding the New Zealand regulatory environment around use of insecticide impregnated nets.

2.Overwintering traps

- BMSB seek out concealed, sheltered locations during their overwintering period.
- Boxes filled with paper, or straw mats can be used as traps outside to attract overwintering bugs as can special "slit" traps of layered pieces of plywood. BMSB crawl into the slits cut between boards and are trapped. These traps can then be dosed with an insecticide.
- After overwintering, BMSB are considered to be most susceptible to toxic insecticide residues.
- Considering a single trap can catch more than 2000 bugs, and an adult BMSB can lay up to 250 eggs a season, that's potentially up to 500,000 BMSB removed from the following season with a single trap.

Overwintering traps (left) and traps with pheromone lure attached/black bag (right).

Knowledge gaps to be addressed by current and future research

- Trap design and effectiveness.
- Creating a grower guide on how to make overwintering traps.

BIOPESTICIDES

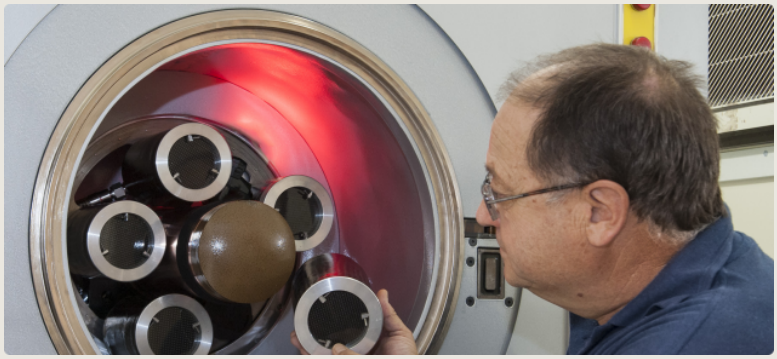
- Biopesticides can provide further alternatives to chemical control.
- Kaolin is perhaps the most promising to date, providing significant control of BMSB nymphs and adults. It is a mineral that acts as a behaviour deterrent, preventing insects from reaching vulnerable plant tissue and acts as a repellent by creating an unsuitable surface for oviposition and feeding.
- Kaolin is available in New Zealand as Surround WP (Etec) and used on apples and grapes for sunburn and heat stress. It is sprayed on crops as a liquid, which leaves a white powdery film on the surface of fruit, stems and leaves when it evaporates. The material has no environmental side effects however the powdery film can be difficult to remove from some produce, resulting in deposits remaining on fruit after picking/packing.
- Kaolin is proven effective under mild to moderate pressure and may be suitable for use around orchards surrounds/shelterbelts.

Knowledge gaps to be addressed by current and future research

- Use of Kaolin on fruit or shelterbelts within the Zespri Crop Protection Standard (CPS) for conventional and organic growers.
- Better understand the ability to clean marked fruit in the production line.
- The value of Kaolin under heavy pressure.

STERILE INSECT TECHNIQUE

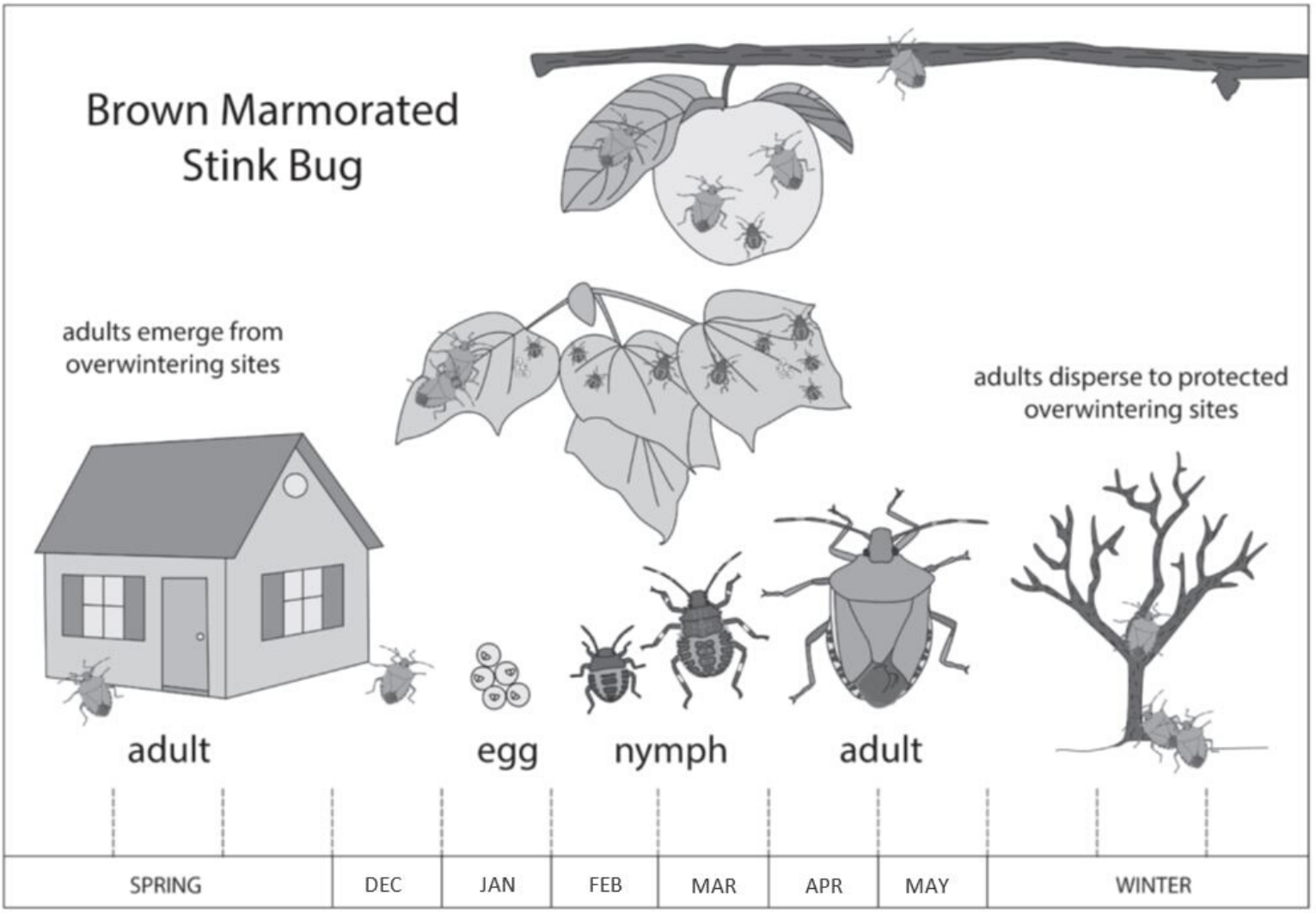
- Sterile Insect Technique (SIT) is a novel tool that has proven success in fruit fly and Painted Apple Moth eradications. It has not been used for BMSB as its biology makes the tool more challenging to apply and is subject to further research efforts which we are supporting.
- SIT involves the release of large numbers of sterile male BMSB, which mate with the females resulting in no viable offspring and a reduction in population density.
- Repeated releases over low population densities will reduce the numbers even further, ideally resulting in population collapse.
- Currently the most likely scenario would be that BMSB would be collected from overwintering aggregations in the US, irradiated and then imported into New Zealand for release.



Technical officers have used this x-ray irradiator to sterilise fruit flies in Australia, before they are released as part of response efforts (image credit Department of Agriculture and Food, WA).

LIFECYCLE OF A BMSB

Eradication of BMSB is extremely difficult and early detection is crucial for success. Public reporting of suspect finds is crucial. KVH has produced fact sheets, posters, key rings and fridge magnets for all growers and community members to raise awareness of this pest, the damage it can do, and the importance of reporting.



For further information contact KVH:
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www.kvh.org.nz/bmsb

If you come across a BMSB catch it, snap it, and report it to the Bosecurity New Zealand pest and disease hotline on 0800 80 99 66 or KVH on 0800 665 825.