TOOLS OF THE BIOSECURITY TRADE

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Outdoor capsicums in the United States surrounded by a trap crop of sorghum and sunflower to attract brown marmorated stink bug away from the crop

During a biosecurity response, officials can utilise a range of biological, chemical and cultural tools to help prevent the establishment and spread of a pest in New Zealand. The Biosecurity Act 1993 provides the Ministry for Primary Industries (MPI) with the mandate to use a range of tools in a response situation, provided any other controls and approvals are met.

We investigated these biosecurity response tools and highlight examples of their contribution to protecting our environment, economy, and way of life from exotic pests, pathogens and weeds.

1. Biological tools: biocontrol and biopesticides

One tool for responding to a pest is biological control – the intentional release of a natural enemy for controlling pest populations. The history of biocontrol in New Zealand is extensive with many biocontrol releases being an insect for the control of an invasive weed (for example Honshu white admiral butterfly for Japanese honeysuckle) or a small parasitic wasp for the control of an insect pest (for example *Tamarixia triozae* for tomato potato psyllid (EPA, 2023)).

The use of biocontrol is not a guaranteed solution for eradicating an unwanted pest, but instead is a tool that can assist with controlling pest populations. Biological control is important as it offers a chemical-free, cost-effective, and self-sustaining tool that can provide ongoing management of the target pest (Jaiswal et al. 2022). It can also potentially be used in locations where use of chemical tools would be difficult, such as near waterways.

Biopesticides are derived from naturally occurring biological organisms or substances and can be another effective biological tool for managing or eradicating pests (EPA, 2022).

There are two main biopesticide classes:

- Biochemical: controls pests through non-toxic means e.g., chemical lures on traps or mating pheromone disruptors, for example Queensland fruit fly trapping in Auckland in the successful 2015 eradication response (MPI, 2020).
- Microbial: contains natural enemies of the pest, for example a bacteria or fungus in a liquid which is then sprayed in the target pest area.

Advantages of using biopesticides include specificity to the target pest, being efficacious in small quantities and being non-toxic and more efficient at biodegrading than conventional pesticides (EPA, 2022).

2. Chemical tools: chemical sprays and fumigants

Chemical biosecurity tools involve the intentional application of pesticides for the control or eradication of a pest. During a biosecurity response, chemical pesticides (with the appropriate approvals) offer biosecurity officials an effective tool capable of rapidly controlling target pests. Application types can include:

- Sprays – spray bottle or canister for flying insects in localised areas
- Certified operators with knapsacks
- Fumigation – gas or vapours to kill pests in an enclosed space, for example containers
- Helicopters and drones – aerial discharge of chemicals over targeted areas, for example individual treetops
- Aircrafts – more extensive aerial spraying.

The choice of application method is dependent on many factors such as the type of pest (for example pathogen vs insect vs weed), level of infestation, environment (for example productive land vs urban vs native estate), location, health and safety and regulatory guidelines (Deskera, 2023).

Each of these application methods have their advantages and disadvantages. For example, spraying by aircraft enables the operator to cover a much larger land area than targeted spraying by a drone. However, the potential for adverse impacts to any susceptible non-target organisms is greater as the spraying is not targeted to individual trees (Chagnon et al. 2015).

During a biosecurity response, time is critical and chemical tools can be the difference between a successful eradication attempt or not. Pesticides are an important tool as they are relatively fast-acting, efficacious against the pest, and versatile as they can be applied using different methods.

3. Cultural tools

Cultural tools refer to the physical and mechanical practices used by people to change the environment to make it undesirable for pests and diseases. These tools and practices can include:

- Crop rotation to distance a soil pathogen from the susceptible host
- Removal of weeds by hand or controlled burn-off
- Pruning of infected plant material or removal of host plants
- Grazing stock for weed consumption
- Removal of 'waste' fruit from crops to prevent pest reservoirs
- Humidity control to make the crop environment unsuitable for pests or pathogens to thrive
- Trap crops to lure pests away from the primary crop.

Trap tree with lures for brown marmorated stink bug in an apple orchard in the United States. This causes the bugs to gather in one part of the orchard

Cultural tools such as host removal can be critical in a response as it changes the suitability of the environment for a pest that is reliant on one type of crop. For example, the pea weevil was discovered in Wairarapa between 2016 and 2017 and was successfully eradicated through a number of cultural tool methods such as banning the movement of pea products out of the region and halting pea production, which effectively starved the weevil population (MPI, 2023). Trap crops can also be used to lure large numbers of pests to a favourite host where they can then be collected and treated or removed from the population.

Cultural tools can be longer-term, for example crop rotation, or can have immediate, observable benefits, for example the physical removal of weeds. Other benefits include long-lasting impact such as stock continuously grazing to consume new weeds before they set seed. Cultural tools are generally environmentally friendly compared to conventional agrichemicals as no chemical application is required (Bugwood, 2012).

Integrated use of tools

In many instances two or more of these tools are used simultaneously to maximise the chance of eradication or long-term management success. The use of multiple tools can improve the outcome by targeting different life stages of the pest, removing individuals from the incursion population, knocking down mobile life stages to prevent further spread, making the environment at the site of detection less favourable for establishment and preventing mating. In many cases, using an integrated approach lessens the chance of the pest establishing. If it does establish, a combined approach can slow the spread and reduce the impact of the pest.

Many growers are familiar with integrated pest management and will use a range of the above tools in their usual production practices. The same types of tools are deployed for biosecurity incursions, and all are important for protecting our sector from exotic invaders.