Lessons for Conservation Biological Control in Raspberries: When Mixed Species Flower Strips Don't Work

Dr Jon Finch, Researcher in Entomology, University of Tasmania-Tasmanian Institute of Agriculture

- The Tasmanian Institute of Agriculture conducted conservation biological control (CBC) trials on commercial farms with the aim of creating an environment where existing natural enemies could survive, reproduce and provide more effective pest control
- While the trials were challenging to establish, some key take-home messages have been prepared and are shared here
- Successful IPM comes from understanding the ecology of the whole production system and identifying the integrated factors limiting beneficial insects

What is the concept of Conservation Biological Control?

Conservation biological control (CBC) is an Integrated Pest Management (IPM) strategy that aims to improve natural pest suppression by supporting beneficial insects already present on the farm. These beneficial insects may either prey directly on pests or develop inside a host insect, eventually killing it. Beneficial insects with this unusual life cycle are known as parasitoids. CBC seeks to create an environment where these existing natural enemies can survive, reproduce and provide more effective pest control.

A common CBC approach is to establish flowering plants around crops. These plants provide shelter, pollen and nectar to improve the survival and reproduction of many beneficial insects. However, simply adding flowers to a farm does not necessarily improve biological control. CBC works where there is a clear ecological link between the flowering plants, the beneficial insects and the target pests.

Tasmanian CBC trials

The Tasmanian Institute of Agriculture (TIA) recently conducted CBC trials on Tasmanian commercial farms as part of the '*Integrated pest management approaches to address pest challenges in raspberry and blackberry* (RB21000)' project, funded by Hort Innovation's raspberry and blackberry research and development levy, and contributions from the Australian Government.

The aim of the CBC trials was to determine whether carefully selected flowering resources would increase populations of beneficial insects within adjacent raspberry crops and improve biological control of important raspberry pests. Flowering plants were selected after examining the existing CBC literature and choosing plants with a proven record of appealing to beneficial insects in other crops.

Two 50-metre mixed species flowering strips were established within the leg rows between raspberry tunnels on two farms. The strips comprised a mix of flowering species selected to provide flowers throughout

the growing season. These included calendula, basil, buckwheat, coriander and English lavender.

The research team discovered that establishing flowering strips from seed in leg rows was not without its challenges. Each leg row was mown and covered with a layer of compost before sowing. In subsequent seasons, herbicides were used to reduce grass competition within the strips and promote the flowering plants.

Not all flowering species persisted beyond the first season. Buckwheat, for example, established well initially but gradually disappeared over time.

Over two seasons, the TIA research team monitored both pest and beneficial arthropod populations in raspberry plants growing adjacent to the flowering strips.

What were the outcomes?

The mixed species flowering strips established relatively well and produced abundant flowers throughout the season. However, despite this, the TIA team detected no measurable increase in predator or parasitoid abundance within adjacent raspberry crops and no corresponding reduction in pest populations.

Although this was not the outcome the research team had hoped for, negative results provide valuable information and can make a positive contribution to longer-term understanding. They help to identify which IPM strategies are most *likely* and *least likely* to deliver benefits under commercial Tasmanian conditions.

There were several observations that sparked researcher interest and increased their current knowledge. Some flowering species, particularly calendula (Figure 1), were shown to provide overwintering habitat for significant Rubus pests, including bronze leaf beetle and green vegetable bug. One important lesson was that flowering plants may support both beneficial insects and pest species simultaneously. This reinforces the importance of carefully selecting, trialling and monitoring plant species when designing CBC programs.

What is the take-home message from this trial?

Conservation biological control is not simply about adding flowers to a farm.

A useful analogy may be to think of CBC as an attempt to improve a sporting team's performance. Providing the players with better nutrition may improve performance, but only if nutrition is the factor limiting the team's success. If the problem is injury, fitness, or coaching, improving nutrition alone is unlikely to change the outcome.

The same principle applies to biological control. Flowering plants will likely only improve pest suppression if access to pollen or nectar is a limiting factor for the reproduction and healthy survival of beneficials. The results suggest these are not in fact limiting factors in Tasmanian raspberry production and other limitations may be at play.

What other factors should be considered?

Many of the key pests in temperate raspberries, including two-spotted spider mite, western flower thrips and mirids, are controlled by predatory mites and predatory insects that do not appear to be strongly limited by access to floral resources. Their abundance and effectiveness are likely to be influenced by many interacting factors across the farming system.

These may include a combination of crop protection treatment use (including insecticides, herbicides and fungicides), tunnel temperature and humidity, crop sanitation practices, harvesting operations, substrate management, fertigation, and prey availability.

Is there a place for CBC in Rubus production?

Yes, but maybe not in temperate regions under current pest and disease pressure. The mixed flowering species trial results do not mean CBC is ineffective in all scenarios. Rather, it highlights that CBC needs to be carefully targeted. Before introducing flowering habitat, it is important to understand what is limiting the beneficial insects responsible for controlling key pests.

Parasitoid wasps often benefit from access to pollen and nectar. With flowers, parasitoids live longer, lay more eggs and kill more pests. In systems where the key natural enemies are parasitoids, mixed flower strips may still be a valuable tool for pest management.

For example, CBC may still have a valuable role in sub-tropical Rubus production systems. Project partners, NSW Department of Primary Industries and Regional Development (NSW DPIRD) are continuing to investigate CBC approaches for stink bug management in systems

Figure 1. Calendula established well in the leg rows on raspberry farms but unfortunately proved a popular food source for several key pests, including green veggie bug and bronze leaf beetle

Photo credit: Jon Finch (UTAS-TIA)

Figure 2. Unlike the Tasmanian trial, the NSW DPIRD team are evaluating potted flowering plants within raspberry rows to improve establishment and increase floral resources available to beneficial insects targeting stink bugs

Photo credit: Jaher Ahmed (NSW DPIRD/ UTAS-TIA)

where native egg parasitoids, such as *Trissolcus* wasps, occur naturally. In these situations, flowering plants are very likely to improve the survival and effectiveness of parasitoids that directly attack the target pest.

Unlike the Tasmanian leg row CBC approach, the NSW team are trialling pot-grown mixed CBC plants within raspberry rows (Figure 2). This approach is being tested to avoid direct seeding establishment issues and increase the number of flowers available to beneficial insects within the crop. The results of this trial will become available in late 2027.

What can growers do now?

The findings from the Tasmanian trial on mixed species flower strips should not discourage growers from considering CBC. The key learning is to take a systems approach to pest management.

Rather than focusing on a single intervention, growers should aim to create conditions that allow key beneficial species to thrive throughout the production system. This may include:

- selecting crop protection treatments that minimise impacts on predatory mites and other beneficial insects
- avoiding unnecessary calendar-based crop protection treatment applications that remove both pests and their natural enemies
- implementing regular crop monitoring so management decisions are based on pest and beneficial populations rather than predetermined spray schedules
- releasing biological control agents at appropriate times and densities
- considering how the wider production system, including climate, irrigation, fertigation, harvest practices, pesticide programs and other horticultural practices, may be influencing beneficial insect populations

As it continues, the project is reinforcing an important principle of IPM: there is rarely a single solution to improving biological control. Successful IPM comes from understanding the ecology of the whole production system and identifying the integrated factors limiting beneficial insects. Growers should continually ask themselves: What is limiting biological control in our production system, and how can we remove those constraints?

Register at

bit.ly/BA-Webinar291026

THURSDAY 29 OCTOBER
2.30–3.45PM AEDT

Rubus IPM: Making the Right Decisions This Season

Block out your calendar and join Jon Finch (TIA) and Rubus IDO Mark Salter (Fruit Growers Tasmania) for this webinar where they will share the latest findings from the ***'Integrated pest management approaches to address pest challenges in raspberry and blackberry (RB21000)'*** and discuss what they mean for practical pest management decisions this season.

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Dr Jon Finch | jonathan.finch@utas.edu.au

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