Polytunnel length key to providing consistent climate for plants and pollinators

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Protected cropping systems are increasing in popularity to manage environmental risks and produce a consistent quality product with a longer harvest window over the year. This protected environment results in a difference of temperature, wind, humidity and light throughout the length of the structure.

Horticulturalists from Costa Group Maurizio Rocchetti and Derek Wright have observed changes in pollinator activity along tunnels and corresponding gradients in fruit size and quality. A collaboration with researchers from University of New England led a study investigating the effects of polytunnels on bee visitation and fruit quality, based in Corindi NSW and Walkamin, QLD.

Pollinator behaviour in tunnels

The internal microclimate of a tunnel has implications both on pollinator presence and behaviour. Blueberry and raspberry tunnels demonstrated warmer average temperatures and lower wind speeds with increasing distance from the edge of the tunnel.

For raspberries in Corindi, pollinators were mainly honey bees (total of 5,698) followed by stingless bees (2,034) and sweat bees (250). The warmer centres of raspberry tunnels had fewer visits by honey bees and stingless bees. However, the warmer tunnel centres didn't deter the wild native sweat bee species *Homalictus urbanus* which provided fewer yet consistent visitation to flowers across the length of tunnels.

In north Queensland blueberries, the pollinator demographic consisted almost entirely of honey bees (1,762), with sweat bees and stingless bees not detected in significant numbers. Bee species were most present and active near the ends of each tunnel, with fewer bees operating near the warmer centre of each tunnel. Other foraging insect species including hoverflies, houseflies and butterflies were also occasionally observed visiting blueberry flowers within the tunnels.

Tunnel impacts on fruit quality

Ensuring adequate pollination is a high priority for berry growers, since fruits are a result of pollination of berry flowers. Guaranteeing pollination in blueberries can be tricky, as blueberries vary from self-fertile to self-infertile depending on cultivar. Increasing pollination in blueberries is reported to increase fruit weight and shorten fruit development times.

Blueberry quality was shown to be significantly better for plants located at the ends of tunnels and related to visitation by honey bees. Greater visitation by honey bees resulted in higher average berry weights and berry yield per plant. The total fruit yield per plant was also higher on plants situated at the ends of tunnels also as a result of the increased visitation by pollinators.

Managing pollination in raspberries, blackberries and other Rubus sp. berries was also shown to be important for maximising fruit quality. In most Rubus species, each berry flower is composed of 100-125 pistils, each requiring the transfer of pollen to create a mature seed. These individual structures form a drupelet, and 75-85 drupelets are needed to form a complete berry. Raspberry fruit quality was most impacted by higher tunnel temperatures, and an average of seven visits by a honey bee was shown to be required for high quality, symmetrical raspberries with few or no defects.

This means that good pollination and a lot of bee activity is critical for ensuring commercial quality fruit and avoiding crumbly, misshapen second-grade fruit. In this study, visitation by sweat bees was shown to reduce crumbliness and there was also a weak, yet significant link between good fruit quality and visitation by stingless bees.

Managing tunnels for consistency

The tunnels used in the study were 100 metres in length and showed variations in temperature and humidity between the ends and centre of the tunnels. Honey bees are already the main species used in managed hives, however stingless bees are increasingly being used in managed pollination.

Pollination researchers suggest limiting poly tunnel lengths to ensure a more consistent climate and allow fly-through of all pollinators, since both honey bees and stingless bees were found more often at the edges of tunnels rather than in the centre. Shortening tunnels would achieve more consistent conditions throughout their length, improve airflow and reduce heat stress on both pollinators and plants.

Growers using longer tunnels can also look to encourage native bee species Homalictus urbanus to improve pollination performance. In this study, it was found that these ground-nesting bees were actually nesting at the base of the raspberry plants in built-up, bare earth.

A simple strategy to encourage sweat bees to occupy tunnels would be to provide a habitat by ensuring there are similar areas of bare, mounded earth within raspberry tunnel structures. The sweat bees also demonstrated little sensitivity to temperature variations across the length of the tunnel, providing important pollination services in areas avoided by other bee species.

The article, *Bee Visitation and Fruit Quality in Berries Under Protected Cropping Vary Along the Length of Polytunnels*, is published in the Journal of Economic Entomology and can be viewed via this link: academic.oup.com/jee/article-abstract/113/3/1337/5809826

Fruit Growers Tasmania

Raspberry tunnels at the Walkamin site in Queensland.
Photo credit: Mark Hall

Native stingless bee on raspberry flower.
Photo credit: Jeremy Jones

Honey bee on blueberry flower.
Photo credit: Jeremy Jones