Autonomous pollination using miniature drones – alternatives to honey bee pollination

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Singaporean company Polybee is investigating the use of miniature drones to pollinate crops grown in greenhouses and polytunnels as part of a Hort Innovation project looking at alternatives to honey bee pollination. The team from Polybee has been trialling their technology in collaboration with Perfection Fresh in South Australia and Western Sydney University, and were recently in Victoria to see how strawberries are grown in protected cropping systems.

The project 'Development of non-biological pollination options for protected cropping using emergent technologies (PH19000)' is funded by the Hort Frontiers Pollination Fund, part of the Hort Frontiers strategic partnership initiative developed by Hort Innovation, with co-investment from Polybee Pte. Ltd, Western Sydney University, Perfection Fresh Pty Ltd and contributions from the Australian Government.

Honeybees struggle in greenhouse situations, and bumblebees which are used for pollination in the northern hemisphere, are not present on mainland Australia. For greenhouse grown tomatoes, pollination is often done by hand which is labour intensive. As more berries are grown in protected cropping environments, optimising pollination for better fruit development and yield will become more important. This project is investigating whether autonomous drones can be used to increase pollination in self-fertile crops, such as strawberries and tomatoes.

Polybee's proprietary method, Aerodynamically Controlled Pollination (ACP) pollinates self-fertile crops by using the downdraft from the drone's propellers as they hover above flower clusters to vibrate flowers and disperse pollen. The down draft from the drones can be optimised for different flower and truss architectures.

Automation has the potential to enhance productivity through the reduction of operational costs on labour for manual pollination in crops such as tomato, as well as higher yields through greater control of pollination.

One of Polybee's autonomous drones at work in a strawberry glasshouse overseas. Photo credit: Polybee

(L-R) Tzi Wah Yeo, Dominic Spirli, Pankaj Malik and Siddharth Jadhav at Spirli Strawberries in Wandin, Victoria
Photo credit: Angela Atkinson

Polybee are using off-the-shelf drones that are only 15cm by 15cm in size, controlled by a phone app, and after mapping the greenhouse environment or tunnels the drones then navigate the space autonomously to facilitate pollination. When the drones run out of charge, they return to the charging dock and recharge wirelessly before setting off again.

In trials in the UK, ACP was found to increase pollination and yield in strawberries in glasshouse production. A potential benefit of this system for strawberry production is the ability to increase pollination, and hence yield, at the shoulders of the season in southern Australian growing regions when temperatures are not optimal for honeybees and other pollinating insects.

Polybee are also using their autonomous drones and AI to give accurate yield forecasting and are working on systems for plant stress detection and growth monitoring.

Trials were conducted at Western Sydney University on strawberry pollination in a glasshouse setting in collaboration with Dr. James Cook's research group.

It was observed that ACP demonstrated significant improvement in fruit set and quality when compared to the negative control and manual pollination. The research team visited Spirli Strawberries in Wandin in the Yarra Valley while they were in Victoria to see how strawberries are grown under tunnels, the differences between the commonly grown commercial varieties, and whether their drone system would work in those situations.

Polybee are hoping to partner with strawberry growers to conduct field trials on commercial farms in the coming season to investigate whether ACP can increase yields in protected cropping grown strawberries.