APIMONDIA SCANDINAVIA 2025
SWEDEN | DENMARK | NORWAY

PP-585 [Pollination and Bee Flora]

Automated monitoring of pollinator visitation in agriculture

Sandra K Evans and GC Clouston

BeeHero
www.beehero.io
hello@beehero.io
Palo Alto, CA

Introduction

A significant proportion of agricultural crops are dependent on insect pollination, by both wild bees and managed honey bee colonies. Monitoring and measuring the presence, density and diversity of pollinators as well as their distribution in the crop provides further understanding of the dynamics of pollination communities in an agricultural context and how they affect crop yields.

Traditional methods for estimating pollinator visitation rates (bees on flowers, BOF) rely on manual observations, which are time-consuming, labour intensive, and often lack granularity. Consequently, growers frequently encounter undetected pollination deficits during this critical stage of crop development. Insufficient pollination results in both lower crop yields and poor quality produce, leading to economic losses for growers and seed producers, impacting incomes, market prices and customer satisfaction and ultimately, food security.

In-Field Sensor

Light
Tracks photoperiod and meteorological conditions.

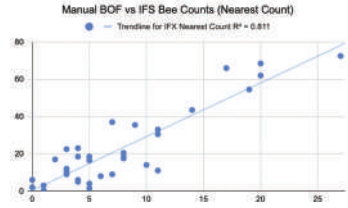
Humidity
Optimises fungicide application timing.

Temperature
Monitors growing degree days, frost alarms.

Accelerometer
Ensures correct installation, orientation and maintenance.

Acoustics
Identifies winged pollinators and pests, without the need for line of site.

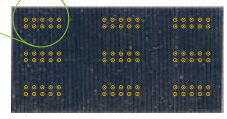
Accuracy



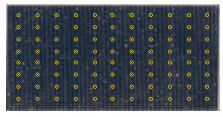
The number of bees observed manually vs. in-field sensor bee counts using acoustics

Topology

Sensors can be spread in an even mesh across the whole field giving both spatial and temporal information. This generates useful information on the consistency of pollinator distribution. Alternatively, the sensors can be distributed in multiple high density clusters, generating much higher resolution data on pollinator visits. A typical application of clustering is when evaluating relative pollinator visitation to male and female lines, and the pollinator distribution between them, during hybrid seed production.



Cluster: Small groups or clusters of sensors



Mesh the whole field using hundreds of sensors

Crop Types

The sensors have been used worldwide across various crops to monitor pollination and optimize hybrid seed production and pest management.

- Apple
- Almond
- Avocado
- Blueberry
- Broccoli
- Canola
- Carrot
- Kiwi
- Macadamia
- Onion
- Oil seed rape
- Radish
- Raspberry
- Strawberry
- Sunflower
- Watermelon

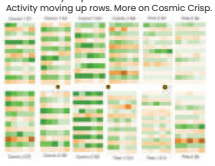
User Interface

BeeHero monitors pollination activity, temperature, and humidity across the entire crop, giving growers a complete picture of their fields. Building on this, we now also track biodiversity and pest presence, providing deeper insights that support stronger yields and healthier hives.

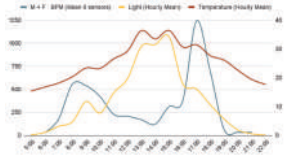
Results

First 5 Days in Apple Orchard
Bee activity closer to hives. More activity on pink lady. More activity on pollinizers.

Last 5 Days in Apple Orchard
Lower activity on pollinizers and overall. Activity moving up rows. More on Cosmic Crisp.



Impact of Environmental Conditions on Bee Foraging in Vegetable Seed



Bee Visitation to Different Cultivars of Almonds

Real-time, In-Field Response

One of our growers consistently noticed lower yields in one corner of their field. Using PIP technology, we identified reduced pollination activity in that area. By bringing in more bees at the right time, we equalized pollination and improved yields.

Avg. Bees Per Minute

	May 9	May 10 +8 hives	May 11
Point 1	0.61	↗	0.65
Point 2	0.55	↗	0.80
Point 3	0.48	↗	0.94
Point 4	0.37	↗	0.59

If you can monitor it, you can manage it.

Hazera Seeds of Growth · Limagrain · Bayer Crop Science · syngenta · Pioneer Hi Bred International · Pacific Seeds · Nuk Zwaan · BASF We create chemistry

PP-585 [Pollination and Bee Flora]
Automated monitoring of pollinator visitation in agriculture

Sandra Kordić Evans, George Clouston
Department of Innovation, Beehero Inc, Palo Alto, CA, USA

A significant proportion of agricultural crops are dependent on insect pollination, by both wild bees and managed honey bee colonies. These pollinators continue to face population pressures from a variety of stressors such as agricultural practices, climate change and diseases. Monitoring and measuring the presence, density and diversity of pollinators as well as their distribution in the crop provides further understanding of the dynamics of pollination communities in an agricultural context and how they affect crop yields. Furthermore, it can be used as a useful tool for increasing the efficiency when using managed honey bee colonies, both in terms of quantity and placement. Adapting technology originally designed to monitor in-hive acoustics, simple acoustic sensors are placed in the crop, collecting information about honey bee visits, ambient temperatures, humidities and light levels. Because the sensor is cost effective, hundreds of these sensors can be distributed through a single crop providing spatial and temporal information in real time and over large areas. This data is complemented by flight activity measurements from the hives, namely bee out counts and hive weight data which are transmitted together with crop visitation measurements back to the cloud for analysis and interpretation. Here we present the application of this technology to a wide variety of crop types: almonds, apples, blueberries, watermelons, sunflowers and oil seed rape, as well as hybrid seed production in onions, carrots and radishes demonstrating its ability to accurately map the pollinator activity in the field at any given time. From the perspective of a beekeeper offering pollination services, information in real time on bee activity in the crop enables timely intervention should more bees be required, the need for hives to be repositioned or excess bees to be removed. Lastly we discuss the potential for the use of the in-field sensing for monitoring pollinators in contexts other than agricultural settings. With the growing interest in agricultural biodiversity, this technology offers a reliable tool to monitor pollinator diversity and density in both agricultural landscapes as well as in surrounding land, supporting efforts aimed at pollinator biodiversity conservation and promotion.