



Pollination Guide for the Australian Berry Industry

Blueberries, Raspberries, & Blackberries

Adapted from a pollination guide prepared by the Almond Board of Australia



A GUIDE FOR GROWERS AND
POLLINATION STAKEHOLDERS



berries
AUSTRALIA

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Abbreviations

ABA	Almond Board of Australia
ACPA	Australian Crop Pollination Association
AFB	American Foulbrood (notifiable honey bee disease)
AHBIC	Australian Honey Bee Industry Council
APVMA	Australian Pesticides and Veterinary Medicines Authority
BMP	Best Management Practice
DPI	(NSW) Department of Primary Industries
EPA	Environment Protection Authority
IDM	Integrated Disease Management
IPM	Integrated Pest Management
PHA	Plant Health Australia
PPE	Personal Protective Equipment
SHB	Small Hive Beetle (honey bee pest)
UV	Ultraviolet (light)
WHS	Workplace Health and Safety

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How To Use This Guide

This document outlines Berries Australia’s best management practices (BMPs) for growers and other stakeholders involved in the pollination process. BMP implementation will deliver effective pollination and protect bees from environmental factors during their stay in a blueberry, raspberry, or blackberry crop.

Four key areas are described in this guide where growers and beekeepers can work together to maximise the benefits from bee pollination while preserving the health of honey bees in berry crops including:

- Hive standards, agreements, and audits.
- Reducing pest and disease risks and the National Bee Biosecurity Program.
- Caring for honey bees while in the crop.
- Chemical use in and around the crop.

This guide also addresses the role of native stingless bees in berry pollination.

The guide provides a roadmap and links to further information. Key supporting documents to this BMP guide include:

- Sources of bees for pollination services (Chapter 2).
- Pollination agreement template to clarify roles and responsibilities (Chapter 11).
- Letter to neighbours’ template to help protect bees during pollination (Chapter 12).

Please contact Berries Australia for further crop pollination information and assistance.

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Honey bees are an important
pollinator of blueberry across
growing regions in Australia

Photo credit: Claire McCrory

1. Introduction to Berry Pollination

European honey bees (*Apis mellifera*) referred to as honey bees, are important for the pollination of Australian blueberry, raspberry, and blackberry crops.

Honey bees have long been recognised as the most efficient and effective pollinator for agricultural crops compared with other insects. Honey bees form colonies with large populations of foraging field bees. Individuals have hairy legs and coats readily attracting and moving pollen from one flower to the next.

With this said, there is a role for native stingless bees (e.g., solitary *Exoneura* spp. and social *Tetragonula* spp.) in the pollination of berry crops. *Tetragonula* spp. are especially useful in warmer areas where both managed and unmanaged colonies supplement honey bee pollination. For example, Clarke and Le Feuvre 2023 showed native stingless bees are responsible for 5% of Australian blueberry pollination.

The bumble bee (*Bombus terrestris*) is an introduced species in Tasmania, and on some farms, it can be the primary berry pollinator (Plant and Food Research 2020).

Why should berry growers care about bee health?

Berry growers recognise that healthy honey bees are likely to forage more actively, and this provides greater pollination efficiency and saleable fruit yield. Honey bees provide a valuable resource for berry production.

Mid-season blueberries, requiring pollination in August and September, are one of the first crops for the honey bee season. Servicing these crops may impact hive health for the rest of the year. Honey bees may service multiple blueberry and other agricultural crops, generate honey from native flora, overwinter in public land forests and return to blueberries the following year.

In Australia, the pollination industry has relied on public lands and native flora to build strong hives out of season balancing the needs of crop pollination with foraging of native flora for honey. Native flora for building bees prior to pollination is an increasingly scarce resource. Consequently, beekeepers have been forced to purchase sugar syrup and pollen to feed their bees when native floral resource is not available to them.

It is important that berry growers provide an environment in and around the crop that nurtures honey bees and maintains hive health both during berry pollination and potentially for the crops that follow.

It is hoped that by doing so growers and beekeepers will both benefit from a rewarding and mutually beneficial relationship, with more beekeepers encouraged to provide hives managed for crop pollination, and growers confident they are doing all they can to be good honey bee guardians.

2. Communication Chain for Pollination

The most important tool that beekeepers and berry growers can use to ensure a long-term, hassle free and mutually beneficial business relationship is communication.

Establishing a communication chain among all parties involved in pollination and pest management will help ensure that responsibilities are known, expectations are met, and important information is effectively conveyed.

The parties acting may simply be a beekeeper and a grower but depending on the scale of the operation those involved in the berry pollination process may also include a bee broker, auditor, agronomist, and spray operator. The state government departments of primary industries are also a vital link in the communication chain. Proactive communication with neighbours may help prevent loss of pollinating honey bees.

How to source bees for pollination

Berry growers requiring honey bees for pollination might engage with:

- Local beekeepers.
- Bee brokers and auditors working with the berry industry.
- Other berry growers and berry industry peak bodies including the Australian Blueberry Growers' Association, Raspberries & Blackberries Australia, and the national body Berries Australia.

Native stingless bees for pollination might be sourced via contact with the Australian Native Bee Association (<https://www.anba.org.au/>) with branches in the NSW Mid North Coast, Coffs Harbour, Rockhampton, Gladstone, and Darwin.

Grower communication with beekeepers prior to pollination

Communication is the first step toward a successful pollination season as it ensures expectations between the beekeeper and grower are fully understood. Early season blueberries are one of the first crops to be pollinated at the end of winter. Beekeepers will start preparing their hives as early as January to ensure hives are in good condition and fit for the job. It is important that growers notify beekeepers of their pollination requirements and expectations early to allow beekeepers to put in place specific practices over autumn to meet grower needs.

Topics for discussion between berry grower and beekeeper are outlined below and should be documented in a pollination agreement.

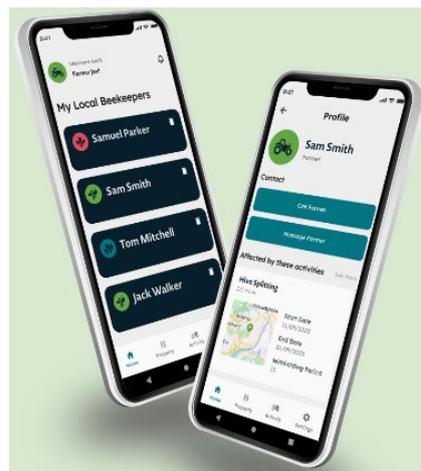
At the end of each pollination season growers and beekeepers should review and document any issues that need to be addressed or any improvements that could be made for the next year. Both parties should communicate these as soon as possible (in December) to facilitate discussion and avoid last minute problems.

THE COMMUNICATION CHAIN



Bee Connected smartphone app.

Bee Connected (<https://beeconnected.org.au/>) is a free nation-wide smartphone app that enables collaboration between beekeepers, growers, and spray service contractors to facilitate best practice honey bee protection. Through Bee Connected registered farmers and contractors will receive notifications when a registered beekeeper places their bee hives near a farm or where crop protection products may be applied. Registered beekeepers also receive an alert when a farmer or contractor intends to use a product to protect their crop. The tool enables instant messaging between beekeepers, farmers, and contractors, whilst maintaining privacy using a restricted in-app messaging service.



Key conversations, roles, and responsibilities

Beekeeper and bee broker should discuss:

- **Pollination agreements** using contracts between the beekeeper/broker and berry grower.
- **Registration** of bee hives with the relevant state government agency.
- **Bee security requirements** for the relevant state including hive branding with the beekeeper registration number.
- **Legal requirements** including interstate hive movement certificates (where required), compliance with wage and salary legislation, and public liability insurance.
- **Hive health related incidents** e.g., suspected pesticide impacts, notifiable pests and diseases (e.g., Varroa mite, American Foulbrood (AFB)) reported to the grower and state government agency.
- **Suspected exotic pest incursion or notifiable pests and diseases** (e.g., Tropiclaelaps mite, Tracheal mite, AFB) reported to the Exotic Plant Pest Hotline 1800 084 881.

Berry grower should discuss:

- **Pollination needs** as early as December to allow beekeepers to prepare for pollination.
- **Pollination agreements** with growers using contracts with beekeepers/bee brokers.
- **Compliance** with the National Bee Biosecurity Code of Practice with beekeepers by obtaining a Certificate of Compliance (Template included as Appendix 1, page 15 of the Code at <https://beeaware.org.au/wp-content/uploads/2017/09/Australian-Honey-Bee-Industry-Biosecurity-Code-of-Practice.pdf>).
- **Engagement** with independent third-party hive health auditor.
- **Specifications** of pollination agreements with other stakeholders involved in the chain (i.e., auditor, agronomist, and spray contractor).
- **When hives will be in the crop** with neighbours and use of a notification letter.
- **When spraying** agricultural chemicals when hives are in neighbouring properties.
- **Pesticide plans** with beekeepers, agronomists, and spray operators.
- **Advanced warning** as early as possible but no later than 48 hours for any chemical whose label states “dangerous or toxic to bees”.
- **Details of pesticide plan** with spray operators using this document and products recommended for use.
- **Hive health related incidents** e.g., suspected pesticide impact, notifiable disease, reported to the beekeeper and state government agency.

State government departments should discuss:

- **Hive registration** and biosecurity risk assessment during pollination season with beekeepers.
- **Beekeeper requirements and responsibilities** under the National Bee Biosecurity Program and Code of Practice to reduce the biosecurity risk.
- **Investigation requirements** during suspected pest and disease related bee incidents with growers, beekeepers, and auditors (as appropriate).
- **Results of pest and disease surveillance** and compliance monitoring activities with growers and beekeepers (as appropriate).

Agronomist should discuss:

- **Spray options** with growers that provide effective control while avoiding harm to bees and promote biological approaches to maintain the natural balance within the crop.
- **Pesticide plans** in consultation with growers, beekeepers, and spray operator including specific application recommendations and products to avoid.
- **Contacting beekeepers** before pesticide application with the grower. This includes beekeepers with hives located in neighbouring properties using the Bee Connected app. Advanced warning of a minimum of 48 hours is mandatory for fungicide products with the statement “dangerous or toxic to bees” on the label.
- **Hive health related incidents** e.g., suspected pesticide impact, with the grower.

Spray operators should discuss:

- **Practices** for spray operators with the grower.
- **Specifications** within the pesticide plan and notify the grower of any proposed changes.
- **Chemical labels** and directions for use with the grower, agronomist, and chemical provider.
- **Routine maintenance and repairs** of chemical plant and thorough cleaning of tanks and equipment to avoid pesticide contamination with grower.
- **Spray timing** of fungicides after dusk to avoid foraging.
- **Maintaining spray diary records** capturing the weather conditions.
- **Hive locations** and duration on or near the crop with the grower.
- **Contacting beekeepers** before pesticide application with the grower. This includes beekeepers with hives located in neighbouring properties using the Bee Connected app. Advanced warning of a minimum of 48 hours for all sprays with a statement “dangerous or toxic to bees”.
- **Hive health related incidents** e.g., suspected pesticide impact, with the grower.

Auditor should discuss:

- **Hive health assessment timing** and approach to determine colony strength (i.e., size of the cluster) and parameters decided in the pollination agreement with growers.
- **Handling of hives with beekeepers** on behalf of growers to ensure minimal disruption to the hive during the assessment.

Neighbours should be notified:

- **Presence of honey bees on farm** and the risk of accidental poisoning and bee stings. Chapter 12 of this guide includes a suggested notification letter for farm neighbours.

3. Hive Standards for Berry Pollination

Hive standards are critical for maintaining bee health and ensuring grower satisfaction. Growers and beekeepers should discuss and agree on their expectation for each other to avoid misunderstandings.

Hive strength

A hive standard refers to the strength and fitness of the honey bee colony: weak; satisfactory; or strong. It includes the number of frames of specified strength for each hive.

The NSW Department of Primary Industries (DPI) AgGuide: [Pollination Using Honey Bees](#) (Somerville and Frost 2018) explicitly states its disapproval of beekeepers who offer substandard hives at a discount. The AgGuide encourages all beekeepers to provide appropriate pollination units.

The NSW DPI AgGuide does not include a hive standard for blueberry, raspberry, and blackberry. It does reproduce the Canadian hive standard for blueberry and comments for the Australian situation have been added by this Guide's authors:

- Eight frames of bees: on standard (full depth) frames
- Six frames of brood (developing eggs, larvae, or pupae)
- An active laying queen (who is 6 to 12 months of age and not a drone layer)
- Little or no presence of honey bee pests and diseases (e.g., Varroa, AFB, SHB)
- Enough stored honey and pollen (at least the equivalent of five frames of honey)
- A hive that consists of two boxes (one with brood and the other honey and pollen)

NB: if berry pollination is to occur in either a polyhouse or tunnel, field bee management is necessary either via hive pick up prior to pollination in the middle of the day (when field bees are absent from the hive), requesting the grower raise the sides of the greenhouse to let field bees escape, or use of a single hive with hatching brood rather than a double hive with more field bees. Field bees accustomed to outdoor conditions will be disoriented by the change in ultraviolet (UV) light and will not be effective pollinators (see Chapter 6 below).

Stocking rate

Once the hive standard is met; the stocking rate can be varied depending on whether the crop is covered or uncovered during the pollination period, planting density, and the number of flowers in the crop:

- **Blueberry** – may require 6-10 hives/ha, but some industry representatives suggest up to 20 hives/ha. The ACPA suggests one hive per 1,000 blueberry plants. Honey bee hives used to pollinate blueberry are “swapped out” every three weeks to maintain colony strength and the effectiveness of crop pollination.
- **Raspberry** – while raspberry flowers produce large amounts of nectar, pollen can only be collected by honey bees in small loads and is not particularly attractive. While stocking rates of 0.5-2.5 hives/ha are suggested in the literature, the Australian industry indicates that a more appropriate rate would be 8 hives/ha.
- **Blackberry** – blackberry flowers are attractive to honey bees and beekeepers can sometimes collect a honey crop during pollination. Because the flowers are attractive, a range of native and other insects visit cultivated blackberry. While stocking rates of 2 hives/ha are suggested in the literature, the Australian industry indicates that a more appropriate rate would be 8-14 hives/ha.

NB: Growers may be accustomed to lower stocking rates than those described above, and these may be inadequate once endemic Varroa mite becomes established in their area. For example, Coffs Harbour berry growers benefit from a significant unmanaged (feral) honey bee population which augments paid pollination services (Dr Doug Somerville, Pollination Auditor, pers. comm., January 2023). Without the benefit of management and Varroa treatment, feral honey bee colonies will collapse and die.

Pollination agreements

Pollination agreements are useful to clarify what a grower is hiring and what the beekeeper needs to supply. It is important that growers and beekeepers specify, and agree, each other's responsibilities and expectations in the following areas prior to flowering:

- The number of hives and hive standard
- Location of hive placement in the crop
- Accessibility of hives to beekeeper and potential site hazards
- Timing to commence gradual introduction of hives into the crop
- Details regarding hive inspection including date, ambient temperature and time of day, number of hives to be inspected and who will be involved e.g., independent auditor
- Proposed pesticide plan and spray diary records of materials used
- Supply and maintenance of a clean water source
- When to notify the beekeeper of signs of dead bees
- Removal and replacement of dead or weak hives
- Timing to remove all hives from the crop/swap out frequency
- Payment terms, including the deposit, progress payment, and final payment
- Contact details and ABN for each party
- Evidence of appropriate insurances including public liability (including third party to cover accidental damages) for all parties

A sample pollination agreement is provided in Chapter 11 for growers and beekeepers to customise to meet individual needs and requirements.

Agreeing on price

The establishment of a price is determined between the grower and the beekeeper depending on the conditions of the agreement and the level of service.

The price is generally driven by grower demand and the beekeeper's ability to supply. In seasons where there is a shortage of floral resource (i.e., drought or bushfire) supplementary feeding may be required. Increasingly beekeepers are practising supplementary feeding in autumn to ensure the best possible chance of pollination standards being met in late winter and spring. Care must be taken by all parties involved in negotiations to ensure the price delivers all the growers' expectations.

It is worth noting that different crop types pay different prices for hives. When comparing crop prices consideration needs to be given to the service being provided. Blueberries and raspberries generally consume honey during pollination whereas blackberries, avocados and macadamia may provide a honey crop (honey is made and stored) while bees are pollinating flowers so hives may cost less. Beekeepers may call for a higher price if providing services above the standard agreement.

Clarke and Le Feuvre 2023 identified the following factors driving price paid by growers:

- Competition for hives in the pollination peak of August and September
- High cost of preparing hives in autumn for the August and September peak
- High cost of transporting hives long distances
- Opportunity cost of honey crop foregone
- Damage caused by crop and production system e.g., bees lose condition in protected cropping
- Non-fee benefits for beekeepers e.g., crop provides pollen or a valuable honey yield

In addition to this list, the cost to beekeepers of managing endemic Varroa mite must now be added.

Hive audit and colony strength assessment

When hives arrive on farm they should be audited by an independent, mutually agreed auditor. These audits assess colony strength (i.e., the size of the cluster) and parameters agreed in the pollination agreement such as the number of frames. An audit assessment will determine if the terms stated in the pollination agreement have been met (refer Chapter 11). Note: it is important that there is minimal disruption to the hive during this process and some parameters, such as queen presence, may not be assessable at this time.

The pollination agreement should describe arrangements for audit assessment. Hives should be assessed within an agreed time of delivery. It is best to let the hives acclimatise to the cropping situation before conducting the inspection. Ideally the audit should be done within seven days of the hives being delivered to the berry crop. Typically, only a representative sample of hives will be inspected – about 10% of hives delivered is recommended.

Growers do not have automatic right to access or move hives as they remain the private property of beekeepers even though they are located on the growers' farm. Accessing hives to ensure they meet the contractual arrangements requires skill and understanding of honey bee biology and behaviour. There is also a safety risk associated with handling bees, so it is vital that audits are undertaken by experienced brokers or auditors and beekeepers are available to assist in handling the hives. The grower should be present and observe the inspection.

Refer to NSW DPI AgGuide: [Pollination Using Honey Bees – Chapter 10](#) for a comprehensive guide to how to assess hive strength and what to look for.

Growers can further monitor colony strength by walking their crops during bee flight hours to observe activity levels. In addition, growers should record hives that appear weak (i.e., relatively few bees coming and going at the hive entrance) or inactive, and then report those hives to the beekeeper. If the foraging bees are not collecting and carrying pollen on their legs, there is little to no pollination taking place.



4. Managing Honey Bee Pests and Diseases

Despite Varroa destructor being declared endemic in 2023, Australia remains free of many other exotic honey bee pests and diseases. Varroa mite, along with a variety of other endemic pests and diseases can affect the health and productivity of a colony if not properly managed.

Beekeepers will be familiar with endemic pests and diseases and how to control them e.g., AFB, European Foulbrood, Chalkbrood, Nosema, Small Hive Beetle (SHB), wax moths, European wasps, cane toads, and ants. More information about honey bee pests and diseases can be found on the [Bee Aware website](#).

Biosecurity risk

In large berry crops there may be multiple beekeepers engaged to achieve the required hive density for crop pollination. The movement of hives within Australia to meet the needs of pollination, together with the robbing habit of honey bees, means the spread of pests and diseases can be difficult to prevent or contain. Unmanaged biosecurity risk discourages prudent beekeepers from providing pollination services.

For example, AFB is an established bacterial disease of the brood which forms spores that may be viable for decades and readily spread when hives infected with AFB are robbed. Robbing occurs when field bees from healthy hives remove honey from infected and weakened hives. In this process, contaminated honey is transported back to healthy hives. The risk increases if infected hives are left for extended periods after flowering as the availability of nectar declines and the tendency to rob increases. If AFB is present in a crop, then all hives within three to four kilometres are at risk of infection.

National Bee Biosecurity Program

AHBIC and Plant Health Australia (PHA) have worked with beekeepers to develop the [National Bee Biosecurity Program](#). The program is underpinned by the [Bee Biosecurity Code of Practice](#) (the Code) which provides a framework for incorporation of biosecurity into everyday beekeeping practice. Compliance with the Code reduces the risk of disease and benefits the beekeeping industry and crops like berries that make use of honey bees for pollination.

The Code has been developed to incorporate fundamental biosecurity principles into the practices of beekeepers including:

- Training and planning.
- Reducing exposure of bees to pests and diseases.
- Controlling pests and diseases.
- Keeping accurate records.
- Hive and equipment maintenance.

Some sections of the Code are mandated under state legislation. State governments have primacy in enforcing the Code and investigating pest and disease incidents.

Beekeepers with more than 50 hives are required to complete an annual [Certificate of Compliance](#) with the Code. Berry growers may request a copy of the Certificate each year from their beekeepers to ensure pest and disease spread is avoided during pollination.

Beekeepers meeting the Code

Beekeepers are embracing the Code to provide assurance for themselves, other beekeepers, and growers that only clean and healthy hives will be brought to berry pollination. The following checklist helps show that beekeepers have prepared for berry pollination in line with their responsibilities under the Code. Growers will know if beekeepers are compliant if:

1. Registration details are current, and branding (registration number) is clearly marked on all hives
2. All hives are structurally sound, have intact external surfaces, and only have openings designed specifically for bee access
3. Brood has been inspected regularly for pests and diseases. Diseased or substandard hives have been removed from the load before arriving at the orchard
4. Hives have been tested for Varroa mite via alcohol wash, soapy water wash, or the sugar shake method
5. Beekeepers have communicated expectations regarding available hive numbers and their quality
6. Records are available detailing inspections, tests, observations, and actions (such as movement) as they relate to the beekeeper's hives
7. A honey culture test to detect AFB has been conducted annually
8. A completed and signed Certificate of Compliance document is available to demonstrate compliance with the Code

An online biosecurity training course has been developed by PHA and is available to anyone at no cost. [The course can be accessed here](#). The course provides an overview of honey bee biosecurity best practice, keeping honey bees healthy, hive inspections, and reporting notifiable pests and diseases.

Additional information on honey bee pests and diseases is available from the NSW DPI and can be found at [Pests and diseases \(nsw.gov.au\)](https://www.nsw.gov.au/pests-and-diseases).

Biosecurity inspection and investigation

Each year beekeepers are required under legislation to register their hives and keep records of subsequent movements within and between states. This enables early contact of beekeepers and location of hives that may require inspection or treatment to prevent pest and disease spread.

It is the role of a state biosecurity officer to quickly ascertain whether hives delivered to the crop pose a biosecurity threat and direct suitable action to destroy the hives to prevent disease spread.

Under the relevant legislation, state biosecurity officers have the right to enter a property to undertake pest and disease surveillance and compliance monitoring activities which may include physical hive inspections to detect biosecurity issues.

Movement of vehicles, machinery, and equipment

Blueberry production spans Queensland (Atherton Tablelands), NSW (Coffs Harbour), Victoria (Yarra Valley, Gippsland, Otway Ranges), South Australia (Riverland), Western Australia (South West) and Tasmania. Raspberry and blackberry production spans South East Queensland, NSW (Coffs Harbour), Victoria (Yarra Valley), Tasmania, South Australia (Adelaide Hills), and Western Australia (South West). The mainland eastern states pollination market functions as a single entity with hives moving between South Australia, Victoria, NSW, and Queensland. Western Australia and Tasmania operate separately and hives for pollination do not cross state borders.

Vehicles and apiary equipment (including forklifts, trucks, hand tools, hive components, and appliances) travel long distances to provide pollination services and it is possible that pests and diseases and weed seeds can be transported onto berry farms. Contaminants can be transported via soil, apiary equipment, vehicles, clothing, boots, and bees which can then spread or be introduced to other properties.

Growers should work with beekeepers to reduce the threat from pests, diseases, and weeds by:

- Adhering to on farm biosecurity practices including any 'come clean, go clean' policies
- Disposal of debris or farm waste away from growing or production areas
- Limiting the movement of vehicles on farm to well-formed roads with appropriate capacity for heavy vehicles
- Regularly cleaning and sterilising all tools and equipment, including hive tools, gloves, pallets, boxes, and any other equipment and machinery
- Erecting biosecurity signs at the property entrance which outline basic requirements for visitors including signing-in procedures
- Implementing a monitoring and pest management program
- Keeping hive sites clean of weeds over the full year to control weed seeds

While inspecting and cleaning machinery can seem onerous, it is easier and cheaper than dealing with a new pest or disease outbreak.



Contaminants can be transported via soil, apiary equipment, vehicles, clothing, boots, and bees which can then spread or be introduced to other properties.

Photo credit: Canva

5. Caring for Honey Bees on Farm

A profitable harvest requires effective pollination. There are a number of simple and practical things berry growers can do to create a farm environment which keeps honey bees healthy and encourages bees to forage and pollinate more berry flowers.

Environmental factors affecting hive health

There are many conditions that affect bee behaviour and health, and measures need to be put in place to minimise or eliminate the impact of the following:

- **Cold weather** in late winter/early spring means that the outer edges of the brood are left unprotected and become chilled. Pollinating hives which meet the hive standard (see Chapter 3 above) help ensure core temperature is maintained.
- **Insufficient nectar and pollen** occurring if hives are brought into the crop too early (without supplementary feeding) and left in too late after flowering, resulting in adult worker bees removing or feeding on larvae and pupae.
- **Overheating in extremely hot weather, or during transport** if bees are confined in their hives and when field bees cannot collect enough water to keep the hive cool.
- **Failing or absent queen** where hives without a healthy and fertile queen stop producing a healthy brood.
- **Pesticide poisoning** with pesticides applied when bees are foraging or collecting nectar or pollen contaminated with insecticide and return to the hive affecting the colony. Bees sprayed directly with agricultural chemical (even if it is non-toxic) will not be able to fly with the weight of spray droplets on their wings. Pollination will be interrupted when pesticide drifts into bees, flowering plants, hives, or the bees' water supply (see Chapter 7).

Selecting a suitable location for bee hive placement

When berries are grown outdoors or pollinated before they are covered, hive location will have a major bearing on pollination success. Depending on elevation and exposure to the sun, the difference in micro-climate temperatures in a crop can be greater than 10°C. Pollination in late winter is sensitive to the impact of temperature and this needs to be properly considered when placing hives. There are also practical considerations in the placement of hives to reduce health and safety risks and assist general farm operations.

Hives should be placed:

- Where they are accessible and convenient at all hours for servicing and removal
- Near flowering forage before and after crop bloom if possible
- With northern and eastern exposures for hive openings to encourage bee flight
- Away from areas prone to shade, flooding, or frost
- Away from abandoned hives or feral colonies that may harbour disease
- Where they can be accessed via roads that are well maintained to enable access during wet conditions and free of obstructions
- Where they have appropriate buffers between pesticide-treated areas
- Away from busy, high traffic areas frequented by field workers who may be stung
- In areas actively managed for weed seeds to prevent spread to new locations

Providing fresh drinking water

Water is important in maintaining the temperature of honey bee hives. The grower should determine who will be responsible for maintaining fresh water for bees to drink during pollination and the water should be free from contamination. The source should be close to the hives (i.e., less than 100 metres) to ensure bees spend more time pollinating the crop than searching for water. A water source near the hive safeguards against bees using water further afield that may be contaminated with pesticides. Water should be checked and replenished throughout the bee's time in the crop.

Landings such as hessian, screens or floats make water accessible and prevent bee drowning. The responsible party should also cover or remove water sources before a pesticide treatment and supply clean water after a treatment is made.

Timing of hive placement and removal

The timing of moving hives in and out of the crop is important to maximise pollination and minimise bee stress. If all the bees required for pollination were introduced at the start of flowering, there are not enough floral resources available to sustain all the bees. Staging the movement of hives in and out of the crop, in relation to the amount of flower, can help reduce the stress on bees.

Ideally hives should enter the crop when about 5-10% is flowering to ensure field bees immediately initiate pollination as they orientate to collect nectar and pollen. However, there may be delays in hive delivery caused by rain, truck breakdowns, poor road conditions, and the high number of hives needing to be delivered at the same time. For these reasons, it is better to start hive delivery when flowering is close to starting.

Growers will need to monitor the flowering process across the crop and keep the beekeeper informed of signs of maturing bud so that hive delivery can be timed. Growers should aim to give beekeepers a weeks' notice of first hive delivery requirements, communication is key. Warm weather may accelerate the opening of flowers. Similarly, cold weather may delay flowering and reduce bee foraging activity.

The authors of this guide recommend the final staged bee removal from the crop be timed for when 90% of the flowers on the latest blooming variety are in petal fall. Pollination does not take place beyond this point, and when bees forage for alternative food sources and water outside the crop – bees can fly up to 6.5 kilometres beyond the crop – they will be at a higher risk of coming in to contact with insecticide or fungicide treated crops on neighbouring properties.

Another option is to provide supplemental forage for bees, particularly before and after flowering. However, even if the timing of bee removal is included in the pollination agreement between the grower and beekeeper, both parties should keep in mind that beekeepers can't always be available, or don't have an alternative location to place their bees.

Unlike bee hive delivery (done in the night) bee hive pickup can be done in late afternoon when hives are loaded onto the truck and secured while the beekeeper waits until all the field bees return to the hives on the truck before driving away. This creates a logistical challenge when hives may become a problem to people who work on the farm. Beekeepers must make every effort to minimise the number of bees that are left behind to minimise the risk to farm staff.

Flowering process

Blueberry

Blueberry growers stage flowering to maintain a constant supply of fruit and avoid oversupply. Flowers stay open and produce pollen for between two and four days (Somerville and Frost 2018).

Blueberry plants form clusters of ground facing bell-shaped flowers, which contain a central style (female) surrounded by shorter pollen producing anthers (male). While flower shape varies, the stigma (female) that receives pollen is usually just at the opening of the flower. The pollen producing anthers are further inside the flower and surround the stigma. Nectar is produced at the base of the flower.

For blueberries to develop, pollen must be moved from the anthers to the stigma by a pollinating insect (Plant and Food 2020).

Raspberry

Raspberries flower from October until April (Somerville and Frost 2018) but can be manipulated to flower all year round (Tyler Scofield, Driscoll's, pers. comm., April 2024). Raspberry flowers have five petals and a ring of anthers. The flowers have many ovules, each with its own stigma. The fertilised ovules are called drupelets.

Raspberry flowers can set seed four days after they open. When pollen is applied to the raspberry flower each day for four days, the seed number increases. This suggests that not all the stigmas may be receptive on the first day. The degree of pollination affects not only the number of fruit but also the raspberry's size and shape. There is usually an increase in berry size with increasing number of drupelets. Increasing pollination also decreases the number of malformed fruit ([Bee Aware website](#)).

Because raspberry flowers produce relatively large amounts of nectar, bees may need to visit fewer flowers to collect nectar and may not spread evenly through a field. If an uneven distribution of bees is noted, more hives should be introduced and spread around the crop.

Blackberry

Blackberries flower from November until January (Somerville and Frost 2018) but can be manipulated to flower all year round (Tyler Scofield, Driscoll's, pers. comm., April 2024). Blackberry flowers have four petals and a ring of anthers. Blackberry flower stigma are surrounded by 50 to 100 anthers. Nectar is produced in a cup at the base of the petals. Flowers start producing nectar as soon as the flowers open and continue until after the petals have fallen.

All blackberry varieties benefit from bee visits to spread pollen to the stigma. The stigma is receptive for the first three days the flowers are open. Honey bees visit blackberries to collect both pollen and nectar. Because blackberry flowers are attractive to bees, hives can be introduced at the start of flowering.

Temperature must reach at least 16°C for honey bees to be active and successfully pollinate any blueberry, raspberry, or blackberry flower (Somerville and Frost 2018).

Supplementary feeding

Increasingly beekeepers are relying on supplementary feeding to maintain hive health and pollination efficiency rather than relying solely on the environment. Drought conditions and bushfires in national parks and state forests have depleted the amount and selection of native floral resources used to build up hive strength and produce honey. This together with the expansion of beekeeping operations means supplementary feeding has become more necessary.



Supplementary feeding is when sugar syrup and/or protein supplements are made available to the hive. There are different types of feeding strategies to encourage brood rearing or to increase hive stores.

Supplementary feeding of sugar syrup may stimulate colonies and enhance pollination activity. Protein supplements may ensure the colony remains in good health despite any nutritional deficiencies associated with berry pollen.

The following causes and effects should be considered (NSW DPI AgGuide 2018):

- The area of brood in a hive is determined by the availability of nectar in the field. No fresh nectar leads to diminished brood rearing
- Increasing supplies of nectar stimulate the colony to increase brood rearing
- The presence of brood sends a signal to the bees that pollen is required
- Stimulating nectar results in greater brood area and hence increased foraging for pollen
- Pollen gathering bees are more efficient at pollinating than nectar gathering bees (8-10 times more efficient)
- The size of brood response to the amount of the nectar and pollen foraged depends on the number of bees in the colony and age of the queen; younger queens respond more quickly to the nectar stimulus
- Hive conditions can be manipulated and potentially produce a more efficient pollination unit (hive). Clearly there is a cost to this extra work, but the bees and the crop can benefit

Supplementary feeding is theoretically a good strategy. However, if hives are constantly opened and closed to provide supplements any beneficial effects may be outweighed by the presence of Nosema, a disease of adult bees. Interfering with hives during early spring and in cool, inclement conditions, may cause Nosema levels to rise and premature death of adult bees.

Alternative floral resources

Research has shown that alternative floral resources such as flowering cover crops, provide honey bees with better nutrition than supplementary feeding. Honey bees with access to alternative floral resources are stronger and forage longer – and strong, healthy bees means better crop pollination.

Alternative floral resources complement rather than compete with berry flowers. They can increase colony strength by extending the foraging period and providing bees with natural nutrition before and after berries flower.

Alternative floral resources can be planted in nearby buffer zones or inter-row. Planting cover crops in late March ensures germination with normal rainfall in autumn and early winter, providing forage blooms in time for pollinating honey bees colonies.

Even weeds with flowering times similar to berries such as brassicas, mustards, daikon radish, turnip weed, and clovers can be beneficial during this time. If possible, avoid spraying these weeds and allow them to continue to grow and flower until after pollination.

6. Managing Bees in a Covered Production System

Importance of covered production

Polyhouses and tunnels account for 60% of Australian blueberry production and 70% of raspberry and blackberry production (Hort Innovation 2024). Covered production creates an artificial environment and restricts honey bee movement.

Management strategies for covered production

If during the night, a beekeeper places a double hive with 12 frames of bees (or more) into a polyhouse or tunnel, most field bees will be disoriented in the morning. Field bees are the oldest bees in the hive and are programmed to travel long distances. If the covered production system restricts the penetration of UV light, the bees may not be able to see normally (Somerville and Frost 2018).

This problem can be addressed by ensuring that the hives placed in covered enclosures have ample amounts of hatching brood. The new young bees will be better adapted to life in an enclosure. In polyhouses and tunnels a single hive with ample hatching brood will be more suited as a pollination unit than a double unit full of older field bees (Somerville and Frost 2018).

The pollination standard for bee hives needs to reflect the modified circumstances presented by a covered production system.

Other points to consider include (Somerville and Frost 2018 and Peter Stace, Pollination Coordinator, River Run Blueberries (retired), pers. comm. April 2024):

Delay covering the crop: Covers may disrupt normal pollinator behaviour. Honey bees forage less under poly covers and can lose strength under such conditions. If possible, berry growers should delay covering their crops until the pollination period is over.

NB: Covered production systems must allow the penetration of UV light or bees will be unable to see. Hives must be placed inside the covered production system, bees will not pass through netting to pollinate blueberries preferring to seek out nectar and pollen from other sources.

Nutrition: The bee colony is likely to suffer nutritionally in a covered production system. With a restricted food source, nectar and pollen are likely to become limiting factors. This problem can be addressed if there is adequate stored honey and pollen or if sugar syrup and pollen supplements are provided to the colonies.

Colony size: Large populous colonies are not suitable because the older field bees become disoriented and end up on the poly coating trying to get out. Smaller hive units are better for polyhouses and tunnels because bees from smaller colonies tend to fly shorter distances. In polyhouses and tunnels, it may be easier to regularly remove and replace smaller nucleus hives so that fresh bees are available to pollinate the berry crop.

Young queen: A hive with a young productive queen and a large amount of hatching brood is ideal. Up to 1,000 new recruits are possible with each day's hatch. These young bees begin to forage within days and are immediately conditioned to the new restricted environment. Few losses occur from these younger bees.

Water: Growers must ensure that clean water is provided to the bees while they are in a restricted environment, especially in hot conditions. When bees become desperate, they will collect water from irrigation drip lines and other leaking pipes, in hot weather it is extremely important for bees to have a clean water source.

Climate conditions: within the enclosure are likely to be quite different to those outside. In polyhouses and tunnels consider placing the hive units on stands well above the ground to avoid cool or excessive humidity. Also ensure that hives are placed where the temperatures promote maximum flight for bees (refer NSW DPI AgGuide, – Chapter 4).

Access for the beekeeper: Beekeepers need access to the enclosure to ensure that they can place and remove hives without damaging the structure or the berry crop. Bee hives are heavy, and it is ideal if the beekeeper can use mechanical aids to move the hive. Workplace Health and Safety (WHS) issues may arise if access is not planned and provided by the grower.

Increased costs: Growers and beekeepers need to be aware of the increased costs involved when hive units are placed within protected cropping spaces. One of these costs is remedial attention required to return bees to good health and productivity after they have been working in the artificial environment.

Time of day: In normal circumstances, it is best to move bees during the night but for enclosures, day time pick up and placement is preferred. The day time move into the enclosure leaves behind all the old field bees which would quickly become disoriented in the new environment and die.

Support hives: If a hive in a polyhouse or tunnel needs topping up with bees, the beekeeper can use a support hive outside the enclosure. The support hive can be a donor of frames of both brood and bees. Hold donor frames away from the hive for about 10 minutes to allow all the field bees to return to the support hive, leaving young nurse bees on the frames. Take the frames with the young bees into the enclosure and shake at the entrance of the hive to allow them to march into it. A prominent platform is required at the front of the hive to allow this to occur.

Colour: The colour of a polyhouse or tunnel may impede bee flight. Bees forage better under white surfaces in preference to dark colours or black. Bees may also benefit from large colourful objects placed in the enclosure to enhance navigation.

Flight space and overhead covers: There needs to be adequate space between the tops of plants and the overhead cover for best bee flight activity. Bees are reluctant to fly under poly covers and it is advisable to spread hives around the crop, no further than 150 metres between placements in cooler climates. Greater distances could be considered in warmer climates.

Installation time: Beekeepers need more time to place hives under covered production than in open air production systems. It takes beekeepers extra time to spread hives further apart in a covered production system and this may have cost implications for berry growers.

Hives must be placed inside covered production systems as bees will not pass through netting to pollinate preferring to seek out nectar and pollen from other sources.

Photo credit: Mark Hall



7. Honey Bees and Pesticides

While not all chemicals are harmful to honey bees, some pesticides are extremely toxic while others may have delayed effects on the health of the colony. Understanding what chemicals to avoid and how to use chemicals wisely will ensure the safety of honey bees before, during, and after pollination.

Insecticides – systemic versus contact

Most of the pesticides that are toxic to honey bees are insecticides and should not be used during berry pollination. Insecticides generally work in one of two ways. Contact insecticides are designed to kill unwanted insect pests upon contact, whereas systemic pesticides are designed to be taken-up through plant tissue, so that the pest insects will ingest the poison as they eat the plant.

Both systemic and contact insecticides can potentially be carried back to the hive in nectar, pollen, and water collected by bees, after the application has occurred. If insecticide residues are attached to pollen brought back to the hive and fed to the bee brood, it may result in deformed wingless bees that fail to emerge from the hive. Because the length of a brood's lifecycle is about 21 days, problems affecting brood may not appear until after berries have flowered. Deformed wingless bees are pulled from their comb cells by other bees and are commonly found in front of the hive entrance.

Some people believe that contact insecticides pose less risk to bees than systemic insecticides, provided that the bees don't come into contact with wet pesticide solution. However, it must be considered that contact insecticides may remain active for several days and may be re-dissolved in dew, which bees may subsequently come in contact with or drink.

In addition, bees may be deterred from visiting flowering plants that have been sprayed with contact insecticides. The deterrent affect can last for several days and compromise crop pollination.

Fungicides

Berry growers may need to apply fungicides during pollination, especially in humid conditions. However, these same fungicides may negatively impact pollination. For example, spraying while bees are foraging weakens the floral scents that draw the bees to the blossom. Research shows that some fungicides, while relatively safe around adult bees, may contribute to brood losses in larval and pupal stages. While most fungicides do not cause harm when used on their own, mixing with other fungicides, insect growth regulators, herbicides, or insecticides can result in toxic combination with harmful effects.

The Guide's authors recommend that during pollination, fungicides should only be applied if deemed necessary, applied as a separate application (not mixed with other chemicals), and only applied late afternoon or evening when foraging bees and pollen are not present.

Honey bees use an enzyme called P450 to detoxify chemicals, and if this enzyme is being used to detoxify one chemical, it may not be available to detoxify another, resulting in poisoning. It is difficult for beekeepers and growers to ascertain which products will pose a threat when applied together.

The simple 'jar test' practiced by many farmers, only provides an indication of whether or not the combination of chemicals can be applied without solidifying and damaging equipment – it does not provide any indication of its efficacy or impact on bees. In the absence of expert advice, the

most responsible approach is for beekeepers and growers to assume that chemical combinations are toxic, and to avoid this practice in situations where honey bees may be affected. Alternatively, beekeepers should consider relocating their hives before spraying to avoid the risk.

Surfactants

Pesticides must sometimes be mixed with an additional product to ensure that the plant protection chemical penetrates the target plant or insect. These additional products are known as surfactants.

Some evidence suggests that some surfactants, designed to penetrate woody plants for example, may also penetrate the waxy cuticle or exoskeleton of the honey bee, its first line of defence against such hazards. In Australia, surfactants and other adjuvants are regarded by the Australian Pesticides and Veterinary Medicines Authority (APVMA) as pesticides in their own right, and are subject to the same assessment, registration, and labelling requirement.

Pesticide label warnings

All new agricultural chemicals are assessed and registered by the APVMA with many pesticides used in horticulture and broadacre farming known to be toxic or dangerous to honey bees. Pesticide labels provide bee related warnings. However, it is important to note that the absence of a honey bee related warning does not mean that the product is entirely safe for honey bees as many herbicides, fungicides, and adjuvants do not contain a bee related warning. Label language will continue to evolve as more information becomes available on the effects of pesticides on bee brood.

In 2012, AgriFutures Australia published a list of 349 broadacre and horticultural pesticides known to be toxic to honey bees in Australia. The publication can be accessed at [12-043.pdf \(agrifutures.com.au\)](#).

Growers can find currently registered chemical products by registered name and active constituent via the APVMA Public Chemical Registration Information System. The system can be accessed at [Public Chemical Registration Information System Search - portal.apvma.gov.au](#).

Integrated pest and disease management

Monitoring for pests and diseases is a key component in knowing when and what pests and diseases are present to target control treatments. Integrated pest and disease management (IPM and IDM) programs will enhance pest control, protect water and air quality, and minimise exposure of bees and pollen to pesticide sprays.

IPM and IDM provide an environmentally sensitive way of managing pests and diseases using a combination of practices (managing inputs and good crop hygiene) and control methods with the aim of preventing problems from occurring and reducing the need for pesticide intensive activities. Sources of information on developing and implementing an IPM and IDM Program in berries can be found in the Plant Protection Guide at the [industry online Resource Library](#).



Berry growers and spray operators should follow precautions to help protect bees from pesticide applications.

Photo credit: Canva

Best practices chemical use to protect honey bees

Berry growers and spray operators can follow the following precautions to help protect bees from pesticide applications:

- Always read the label and follow directions for use
- Discuss your pesticide plan with your beekeeper and agronomist well before the start of the season to select chemicals that are safe for bees while still achieving effective pest and disease control
- Before bloom, avoid applying insecticides with extended residual toxicity or systemic insecticides
- Prior to spray applications, establish clear lines of communication with all involved in pollination and spraying so that each party is informed in advance during this busy season
- During bloom, do not use pesticides with cautions on the label that read “dangerous to bees”, “highly toxic to bees”, “toxic to bees”, “residual times”, or “extended residual toxicity”. Residual toxicity to bees varies significantly between pesticides and pesticide products, and their impact can last from hours to a week, or more
- During bloom, spray fungicides only if essential and only at mid-afternoon/night, when the bees aren’t active allowing time to dry before bees begin foraging the next day. Avoid tank-mixing insecticides with fungicides
- Thoroughly clean spray tanks to avoid remnant insecticide contaminating fungicide sprays
- Surfactants (adjuvants) should not be added to fungicides during bloom, unless stated otherwise on the label. Most fungicides are formulated with adjuvants including wetting agents, spreaders, and stickers
- Advanced warning is mandatory for pesticides with the statement ‘dangerous or toxic to bees’ on the label. Give beekeepers at least 48 hours but more time is preferable. Bees can only be moved at night and under suitable environmental conditions
- Do not spray when exposed pollen is present in berry flowers
- Ensure bees have access to clean water and cover or remove water sources before spraying and replace with clean water immediately after chemical use
- Do not spray hives directly with any pesticide. Ensure that the spray-rig driver turns off nozzles when near hives
- Ensure bees are not foraging in the area that is to be sprayed and do not hit flying bees with spray applications as the weight of spray droplets on their wings will mean they can’t fly
- Be sure to avoid pesticide application or spray drift to blooming weeds in or adjacent to the crop when honey bees are present
- Notify neighbours when honey bees will be in the crop and provide your contact details so they can provide notice before intended sprays
- After bloom, and once the hives have been removed, it is recommended that a check be completed, where the hives were kept, for bees that may still be foraging
- Before making insecticide applications outside of the pollination season register each spray event through the Bee Connected App to check for hives in the area and automatically alert beekeepers (see Chapter 2)

Keep all parties informed of agricultural sprays according to the communication chain agreed upon so that beekeepers are always aware of impending applications and spray contractors are fully informed of the parameters regarding materials, timing, location, climate conditions, and method of application.

Identifying suspected pesticide-related honey bee losses

It is important that growers are able to recognise and respond to a pesticide-related incident. Growers should regularly monitor hives in their crop and check for possible signs of a pesticide-related incident which may include:

- Excessive numbers of dead and dying adult honey bees in front of hives
- In severe cases, dead adult bees will be found inside the hives as well and brood will die from starvation, overheating, or chilling (due to the inability of adult bees to feed brood and regulate hive temperature). This may be observed when a beekeeper/third party auditor undertakes a hive health assessment in response to dead or dying bees
- Lack of foraging bees leaving the hive on a normally attractive blooming crop
- Bees that are lethargic (i.e., dazed, unconscious) or immobile, and are unable to leave flowers
- Bees that are demonstrating jerky, wobbly, or have rapid movements; spinning on their backs; or are excessively grooming
- Disorientation and reduced efficiency of foraging bees
- Bees that are unable to fly and are crawling slowly, as if chilled
- Most or all the hives in an area may be affected
- Dead adult bees often have their wings unhooked and at odd angles to their body, their proboscis fully extended, and their hind legs outstretched behind them
- Remaining bees may behave aggressively

Actions required by growers and beekeepers

If a pesticide-related honey bee loss is suspected, growers should immediately notify the beekeeper. Noting that bees can fly over 6.5 kilometres and spray drift under the wrong weather conditions can travel up to 10 kilometres, so the poisoning event may not have occurred on the current crop being pollinated. If the beekeeper decides to report the incident a proper investigation is important to ensure growers who have done the right thing are not unfairly blamed.

In reporting a suspected incident to the relevant government agency (depending on jurisdiction this may be the state DPI, EPA but ultimately the APVMA), the grower may be required to provide information describing the time, date, location(s), and number of bees killed. If a recent chemical has been sprayed, describe the previous health of the colony, prevailing wind at the time of spraying, registration number from the suspected pesticide label, name of the suspected pesticide and how the bees may have been exposed to the pesticide. Photos or videos of the incident are also of value.

Beekeepers should report pesticide treatments applied to the affected hives and pertinent details related to the health of the bees leading up to the incident.

Immediately freeze as many adult bees and brood plus as much pollen, honey, nectar, and wax as is practical. Store samples in labelled clear containers and mark each sample with time, date and location information. Ample sample material that is clearly labelled will preserve the evidence of an incident and may be helpful if the incident warrants laboratory analysis.

Do not disturb the hives or site when an investigation is pending.

More information about responding to a poisoning event can be found on the [Bee Aware website](#)

For a summary of the information to include and what symptoms to record, download the [Pesticide Poisoning Report](#).

This report is an extract from [Honey Bee Pesticide Poisoning: A Risk Management Tool for Australian Farmers and Beekeepers](#), published by AgriFutures.

Report a suspected pesticide-related event

Anyone with a concern, or knowledge of a spray drift incident or pesticide misuse in their local area should report it to the relevant Environment Protection Authority (EPA) or DPI:

Queensland

Department of Primary Industries, Biosecurity Queensland

www.daf.gov.au

Phone – 132 523

New South Wales

Environment Protection Authority

www.epa.nsw.gov.au/about-us/contact-us/environmentline

Environment Line – 131 555

Victoria

Department of Environment, Land, Water and Planning, Senior Apiary Inspector

www.deeca.vic.gov.au

Phone – 136 186

Tasmania

Department of Primary Industries, Parks, Water and Environment, Spray Referral Unit

www.dpipwe.tas.gov.au

Phone – 1800 005 244

South Australia

Department of Primary Industries and Resources, Senior Apiary Inspector

www.pir.sa.gov.au

Phone – 08 8207 7975

Western Australia

Department of Agriculture and Food, Plant Biosecurity

www.agric.wa.gov.au

Phone – 08 9368 3535

These reports should be submitted as soon as possible after an incident occurs to help ensure the details are documented as accurately as possible.

APVMA reporting

If berry growers have experienced an unintended or unexpected outcome associated with the registered use of a product when used according to the approved label instructions this is called an adverse experience and should be reported to the APVMA. This includes impacts on honey bees.

An adverse experience report can be made online providing as much detail as possible (including details of vets, doctors, and/or agronomists reports, pathology, and post-mortem reports, etc., where appropriate). Please note that the information provided should be accurate and correct.

The APVMA will evaluate all the adverse experience reports it receives involving registered agricultural chemical products in Australia.

The APVMA [Adverse Experience Reporting Program](#) can be contacted by phoning **1800 700 588** or visiting [AERP AgVet Online Report System \(apvma.gov.au\)](#).

These reports should be submitted as soon as possible after an incident occurs to help ensure the details are documented as accurately as possible.

8. Safety On-Farm with Honey Bees

There are common hazards associated with having bees on-site and growers need to be aware of these to make sure all parties involved in pollination, including visitors, are working safely.

Bee stings

NB: All bee stings are painful and all result in a local reaction such as pain, redness, itchiness, and swelling. The reaction may last a few minutes or a few days. A small percentage of people experience dangerous hypersensitive reactions to the sting. If you have no recent history of being stung by honey bees, discuss the subject with your doctor before you go near a bee hive.

Occasionally, some people develop an allergic reaction to stings after two or more occasions of being stung, and some after many years of being stung. However, most people do not become allergic.

Experienced beekeepers anticipate when they are about to be stung and remove the sting very quickly so that only a minute amount of venom is injected into them.

If honey bees attack you (Somerville and Frost 2018):

- Walk calmly and quickly away from the hive the bees are defending. You may need a distance of a few metres or one or two hundred metres
- Walk into a shady area or in among a group of large shrubs
- If possible, get into your vehicle or into a building

If you have a bee inside your veil (Somerville and Frost 2018):

- Leave your hat and veil on until you are inside your vehicle
- Try and squash the bee with your fingers while it is inside the veil
- Get into your vehicle, wind the windows up, and then take the veil off

Keep your hat and veil on in the field.

Sensitive areas for bee stings include (Somerville and Frost 2018):

- Face, mouth, and anywhere on the neck
- Any internal organ: tongue, ears, and eyes
- Any soft tissue particularly under arms and around the face

Farm safety systems

Safety does not occur by chance; it must be managed. It is the result of careful attention to all operations by all involved. All concerned must work diligently to establish and maintain a place of work that is safe and without undue risk to the health and safety of any employee, contractor, or member of the public.

Refer to relevant state or territory Workplace Health and Safety requirements to ensure correct procedures are adopted.

Each person is responsible for the safety of the work environment. However, the farm manager and the beekeeper have additional responsibilities.



Keep your hat and veil on at all times when in field with active bees.

Photo credit: TIA

The farm manager or beekeeper must (Somerville and Frost 2018):

1. **Comply with both the intent and detail of relevant legislation**, such as Australian and International Standard requirements, Codes of Practice, and industry standards. This includes providing whatever is needed to comply
2. **Ensure safe entry and exit** to the farm for all involved.
3. **Provide necessary information**, instruction, training and supervision and appropriate methods of work to ensure safety of all involved. Keep signed records of training given, signed by both the employee and employer. Encourage safety awareness and interaction
4. **Provide personal protective equipment (PPE)** and safety equipment to employees, contractors, and visitors as required. This includes instruction in the use, maintenance, and suitability of the PPE and safety equipment: veil; protective suits; gloves; safety boots; sun hats; and sun screens are just a few examples of appropriate PPE for working with bees in the field
5. **Train staff in emergency procedures** such as evacuation and first aid. More than one person should be trained in first aid because one of them could be the injured person.
6. **Provide a first aid kit** that is easy to locate for treating a minor injury such as a cut or scratch. Have an EpiPen handy for allergic reaction to bee sting
7. **Advise staff on contact details** for medical and other emergency procedures such as ambulance, fire, or community assistance
8. **Have a system for reporting incidents** and follow-up measures

As part of a farm safety system farm managers or beekeepers should also:

1. **Erect signs** at the property entrance to advise visitors, staff, and contractors when bee hives are located on the property
2. **Provide staff and contractors with a hive location map** and schedule activities away from hives and foraging bees to avoid exposure
3. **Ask all visitors/new staff if they are allergic/anaphylactic** to bee stings
4. **Ensure only beekeepers, auditors, or other agreed persons open or move hives** using appropriate PPE

Working in isolation

It is wise to avoid working alone, particularly if the location is isolated. Satellite phones are advisable in case of emergencies.

If you are working alone, have some form of communication (such as a mobile phone, two-way radio) so that you are able to make contact should you require assistance or in an emergency. Advise others of where you will be working and your expected time of return to the main work site, location, or home.

Consider carrying an EPIRB (emergency position-indicating radio beacon).

Manual handling

Beekeepers are well trained in handling bee hives. If assisting a beekeeper in the process of unloading, loading, or moving hives avoid manual handling injuries by:

- Handling smaller loads
- Using a machine if possible (trolley, forklift, mechanical hive loader)
- Employ additional labour to assist
- Practice good body positioning to reduce bending, twisting, and reaching movements
- Allow adequate time to prevent muscle fatigue and strain

Heavy vehicle safety – berry growers’ chain of responsibility

Growers play an important role in supporting safe, reliable road transport for the benefit of all road users. Heavy vehicles (vehicle mass of more than 4.5 tonnes) are often used to bring hives to the farm and growers have a shared responsibility to ensure all parties in the heavy vehicle supply chain always use safe practices within their control.

Growers’ responsibilities when heavy vehicles are owned and operated:

- What and how much is loaded onto the vehicle, how the weight is distributed and how the load is restrained
- Vehicles are fit for purpose, mechanically safe and legally able to be used on a road
- Drivers are not fatigued or tired and don’t work longer than they are allowed by law
- Safety risks of the activity are understood as related to the transport task, including packing goods for transport, scheduling travel and delivery times, and the impacts of delays in loading and unloading trucks
- Avoid requests, instructions, requirements or demands that may influence the driver to speed or drive while fatigued

Growers’ responsibilities when heavy vehicles are contracted via another operator:

- Avoid requests, instructions, requirements or demands that may influence the driver to speed or drive while fatigued
- Ensure stock or loads are ready to load on time so that a driver is not unduly delayed and pressured to speed or exceed fatigue hours
- Ensure safe access while on your property for the heavy vehicles and advise drivers of any relevant local knowledge
- Ensure you consult with your transporter and other parties in the chain when setting timeframes for pickup and delivery
- Use operators that provide safe and compliant transport activities. Consult your provider to ensure any safety risks are understood and steps are taken to mitigate those risks

Best Management Practice for the transport of open entrance bee hives

In the interests of public safety, AHBIC recommends that the following guidelines be followed, except in the case of emergency (e.g., fire, or flood):

- Where possible, only transport open entrance hives between sunset and sunrise unless appropriately netted
- When securing bee hives, equipment or machinery onto a transport vehicle [ensure Load Restraint Guidelines as set down by the National Transport Commission of Australia](#) are adhered to
- After completion of loading of bee hives, wait until most bees have stopped flying before departing the site
- Even in cooler weather, travel through built up areas and road works should be avoided during daylight hours
- Ensure adequate fuel is carried on the vehicle to complete the journey without the need to enter a refuelling depot when transporting open entrance bee hives
- If absolutely necessary that a break in the journey has to occur, then ensure the vehicle is located far enough away from lights as not to attract bees

If the above guidelines cannot be met, AHBIC advises bee hives should be screened, netted, or closed entrance to prevent escape of bees from transport vehicles.

9. Native Bees and Promotion of Pollinator Diversity

Native bees have the potential to supplement honey bee pollination. This chapter reviews that potential as well as opportunities to promote two prospective types – solitary reed bees (*Exoneura* spp.) for raspberry and blackberry pollination and social sugar bag bees (*Tetragonula* spp.) for blueberry pollination. Other prospective types are noted in the literature.

Overview

Australia has approximately 1,650 named species of native stingless bee. These native stingless bees are present across all regions and climatic zones. Most species are solitary or semi-solitary (Reynolds and Robinson 2022).

Individual solitary species, such as reed bees (*Exoneura* spp.), can be highly effective in pollinating raspberry and blackberry flowers. However, as individuals they mostly lack the ‘critical mass’ needed for commercial crop pollination. Reed bees are found from Carpentaria in the north to Tasmania in the south and across to Western Australia. They are called reed bees because individuals nest in the hollowed out pithy stems of plants such as reeds, tree ferns, and grass trees. Reed bees are also found in raspberry and blackberry canes.

Tetragonula spp. (including *T. carbonaria* and *T. hockingsi*) are social native bees that form large colonies similar to honey bees. Colonies consist of a queen, workers, and drones and persist for many years. *Tetragonula* and other native bee species are not impacted by Varroa mite or other honey bee pests and diseases.

Tetragonula spp. are effective blueberry pollinators in tropical and semi-tropical areas including Coffs Harbour. They contribute to berry pollination as either wild colonies or as managed populations hired or owned by the berry grower. Tropical/semi-tropical *Tetragonula* spp. are not suitable for berry pollination in August and September. It is too cold for *Tetragonula* to be active and effective in late winter and early spring.

Review of the literature would indicate that, at the current time, native bee species are best thought of as augmenters of honey bee pollination rather than a ‘standalone’ solution for berry growers. However, much can be done by berry growers to augment the native stingless bee pollination. In so doing, growers are reducing the risk of complete reliance on managed honey bees for pollination and the loss of unmanaged (feral) honey bees with the spread of Varroa mite.

Encouraging alternative raspberry and blackberry pollinators

Brown *et al.* 2022 notes that reed bees nesting in raspberry and blackberry chose upright canes, only make use of dead wood, and do not harm the living crop. Further research is required to understand if changes in pruning strategy could be made to further encourage these supplementary pollinating species.

Nesting habitat for reed bees can also be created by building artificial ‘bee hotels’ – clusters of hollow *Rubus* canes that *Exoneura* spp. can nest in. Reed bees are also more plentiful in raspberry and blackberry crops when native vegetation, that includes tree ferns, is located nearby. Reed bees forage all year round so it is important that they have access to species such as acacia and hakea prior to the flowering of the *Rubus* crop as well as kunzea and pultenaea after the crop has flowered. As with honey bees, reed bees are susceptible to pesticides, and it is advisable not to use insecticide when the crop is flowering (Brown *et al.* 2022).

Encouraging alternative blueberry pollinators

Tetragonula spp. can add to the effective pollination of blueberry crops either as unmanaged or managed colonies. Recently split managed colonies have fewer field bees and will be less effective as pollinators. Sugar bag bee hives are split to increase the number of colonies available to the beekeeper. *Tetragonula* has shown potential as a managed pollinator in covered production systems (Cook 2022).

Tetragonula rely on a range of alternative floral sources before and after blueberry pollination. Recent research has shown that in summer, *Tetragonula* makes use of Euphorbiaceae, Myrtaceae, and Cannabaceae species. In autumn, greatest use is made of melaleuca and eucalyptus species. While in winter, *Tetragonula* tend to source from flowering weeds including Brassicaceae and Asteraceae species. Overall, native flowering trees are the most important source of food and nest materials for *Tetragonula* spp. Access to native flowering trees within 200 metres of the crop will augment the strength and effectiveness of *Tetragonula* as an alternative blueberry pollinator (Whitehouse *et al.* 2021, Cook 2022).

Native Reed bee
(*Exoneura* sp.) on *Rubus*

Photo credit: Alison Hoelzer
Photography



10. Bee Friendly Farms

Initiatives are available to improve the attractiveness of berry farms to both honey bee and native bee pollinators. Initiatives advocated by the [When Bee Foundation](#) and [Bee Friendly Farming](#) span simple science-based practices such as providing nesting habitat for native bees, boosting food sources, increasing access to water, and incorporating integrated pest and pollinator strategies.

By incorporating bee friendly practices, growers can boost farm efficiency, improve biodiversity, and show their commitment to consumers, customers, and communities.

Financial benefits to growers

Bee friendly farming helps growers:

- Boost farm efficiency and productivity through improved pollination
- Improve biodiversity
- Reduce pollination costs
- Show consumers and customers that they are dedicated to supporting pollinator health on their properties
- Become a preferred farm destination for beekeepers by helping beekeepers easily identify farms that place a high priority on the health of bees

Health benefits for bees

Bee friendly farming helps bees and other pollinators by:

- Improving access to alternative food sources that offer a more balanced and nutritious diet
- Increasing habitat, offering nesting resources, and reducing the distance pollinators need to travel to forage and feed
- Improving habitat connectivity allowing pollinators to move freely between habitats
- Reducing the impact of harsh chemicals and pesticides

Five ways to support bees and other pollinators on farms

1. Offer forage that provides good nutrition for bees and other pollinators
2. Provide bloom of different flowering plants throughout the growing season, especially in early spring and late autumn
3. Offer clean water for bees to drink and cool their hives
4. Provide permanent habitat for nesting through features such as hedgerows, natural brush, buffer strips, or bare ground
5. Reduce or eliminate the use of chemicals and practice Integrated Pest and Pollinator Management



By incorporating bee friendly practices, growers can boost farm efficiency, improve biodiversity, and show their commitment to consumers, customers, and communities.

Photo credit: Canva

11. Pollination Agreement Template

This agreement is made on (date) _____

BETWEEN _____

(Grower's name) hereafter called the "Grower"

AND _____

(Beekeeper's name) hereafter called the "Beekeeper"

TERMS OF AGREEMENT

The term of this agreement shall be for the _____ (season) growing season, covering _____ (date) to _____ (date).

(Other agreed provisions should be added or deleted if required at the time of signing, and initialled by both parties.)

SECTION A: RESPONSIBILITIES OF THE BEEKEEPER

Beekeeper agrees:

1. Supply proof of current beekeeper registration with relevant state government department (e.g., Victorian Department of Environment and Primary Industries, Primary Industries and Resources SA, NSW Department of Primary Industries).
2. To supply the Grower with European honey bees as stipulated in the following table:

Hive Number	Description of the hive set-down location	Timing of introduction
		At % of flowering
		At % of flowering
		At % of flowering

(Grower to advise Beekeeper of delivery dates as per Clause 5).

3. Deliver hives each containing a minimum of (higher standards may be negotiated, especially on isolated or problem crops):
 - a. Eight standard (full depth) frames well covered with bees (three quarters covered at 15 degrees Celsius)
 - b. Six frames of brood, 50% covered in brood at all stages of development
 - c. An active laying queen (who is 6 to 12 months of age and not a drone layer)
 - d. At least five full depth frames of honey
 - e. A hive that consists of two boxes (one with brood, one with honey and pollen)
 - f. Sufficient room for colony expansion

4. To deliver hives that have been tested/inspected for the presence of Varroa mite, American Foulbrood, European Foulbrood, Chalkbrood, and Small Hive Beetle in the previous autumn, and demonstrated compliance with the National Australian Honey Bee Industry Bee Biosecurity Code of Practice, by providing the Grower with a copy of the Beekeeper Certificate of Compliance document completed and signed.
5. To deliver each instalment of hives to the property within _____ days of the berry crop achieving 5% flowering or by _____ (date).
6. To place hives in positions decided in previous consultation with the Grower in group sizes of no more than _____ (number) hives.
7. Within an agreed timeframe (_____ days) of notice from the Grower to open and demonstrate bee colony strength of any hives specified by the Grower (such request not to be made unreasonably).
8. To provide permission for an auditor nominated by the Grower to audit the strength and health of the colonies if requested by the Grower within seven days of arrival.
9. To maintain the bees in proper pollinating conditions by judicious inspection, feeding of protein supplements, and if necessary, sugar syrup.
10. To supply within an agreed timeframe (_____ days) an additional hive(s) to compensate for any hive found to be below the minimum standard, at no extra cost to the Grower.
11. To remove the hives within an agreed timeframe (_____ days) of being notified by the Grower that they are no longer required.
12. To take all reasonable measures to reduce the number of field bees left behind in the Grower's property when hives are removed.
13. To collect any bee swarms in the property during the flowering period within an agreed timeframe (_____ days) as requested by the Grower.
14. To carry appropriate insurance e.g., public liability insurance (including third party for accidental damage) and workers' compensation insurance.
15. To abide by farm policies, including but not limited to: personal and professional conduct policies; biosecurity and occupational health, safety and welfare policies.
16. To inspect the property and any site hazards identified by the Grower under Section B, clause 8, such inspection to be in daylight before delivery of hives.
17. Carry out any sanitation of vehicles, hives and associated equipment of all debris, plant, or soil material prior to arrival and before departure as outlined in the Biosecurity Manual for Beekeepers (section 26) and as requested by the Grower.
18. To fulfil all heavy vehicle safety obligations under the National Heavy Vehicle Regulator Chain of Responsibilities (www.nhvr.gov.au).

SECTION B: GROWER RESPONSIBILITIES

Grower agrees:

1. To pay a rental sum of \$ _____ per hive for a total of _____ hives. GST is to be added to all payments.
2. The total rental is \$ _____. This payment is to \$ _____ on or by _____ (date) and a final payment of \$ _____ by the _____ (date) of the month following removal of hives from the property.
3. To pay _____ % (insert) per month (or part thereof) interest on amounts unpaid after due dates.
4. To liaise with the Beekeeper well in advance of hive delivery and allow the Beekeeper prior inspection of the property in daylight.
5. To provide a suitable place to locate hives. This site must provide all weather access to a truck, or other vehicles used in handling and servicing the colonies and be in a sheltered, sunny position.
6. To provide the Beekeeper with a map of the property well before delivery of hives showing the positions in which hives are to be placed, and the number of hives to be placed at each location. The positions will be agreed under Section 1, clause 6.
7. To be present, or nominate an appropriate person to be present, when the hives are inspected under Section A, clause 8, and when hives are delivered and removed (to assist with locating sites).
8. To advise the Beekeeper in writing of any property hazards including drains, wires associated with protected cropping structures, fences, ditches, irrigation pipes, and any other hazard, and to clearly identify the location and nature of such hazards.
9. To allow the Beekeeper entry onto the property at a reasonable time whenever necessary to service the bees.
10. To give the Beekeeper at least _____ hours' notice and _____ hours final notice that hives are required to be placed in the property.
11. Not to shift, examine, or disrupt bee access to or from hives without the Beekeeper's approval.
12. To provide and maintain a clean water source while bees are on-site.
13. To give the Beekeeper at least _____ hours' notice to remove hives from the property.
14. To abide by the appropriate federal and/or state pesticide legislation.
15. To comply with bee-toxicity warnings on agrichemical labels.
16. Not to spray any bee-toxic chemical while the hives are on the property, and in so far as is reasonably practicable, to avoid spraying any insecticide in the ten days prior to hives being shifted into the property.
17. To provide the Beekeeper with a copy of the crop spray diary with the spray activities that occurred whilst the hives were on the farm, thereby facilitating a Maximum Residue Limit (MRL) audit of honey.
18. To avoid spraying any agrichemicals between 08:00 and 17:00 hours when large numbers of bees are foraging, in so far as is reasonably practicable.

19. To provide the Beekeeper with at least _____ hours' notice if anything is to be sprayed on the property while hives are present and to flush any insecticide or other bee-toxic chemical from tanks and spraying equipment before spraying while hives are on the property.
20. To dispose of any insecticide-contaminated liquid or other bee-toxic material so that bees cannot contact or drink.
21. To give adjoining land owners notice of intent to bring in hives at least ten days before the hives are moved into the property and notice of the full period that the hives may be present.
22. To advise the Beekeeper within 12 hours if a significant number (one cup or more) of dead bees are seen near the entrance of any hive.
23. To carry appropriate insurance e.g., public liability (including third party for accidental damage) insurance and workers' compensation insurance.
24. To fulfil all heavy vehicle safety obligations under the National Heavy Vehicle Regulator Chain of Responsibility (www.nhvr.gov.au).

NB: the beekeeper is not responsible for inherent risk of bee stings to people, animals, or livestock. So long as the servicing of the hives is done in a lawful, respectful, and responsible way.

NB: the grower agrees to compensate the beekeeper in full for hives destroyed or severely weakened by pesticides or other action by the grower at a rate per hive to be determined.

PERFORMANCE

Neither party shall be responsible for failure to comply with the terms of this agreement where such failure to comply results from causes beyond the reasonable control of that party, provided however that this shall not relieve the Grower from liability to make payment for services performed.

ARBITRATION

If the Grower is dissatisfied with the quality of hives supplied his/her recourse shall be to the Beekeeper. Such complaints shall be lodged as soon as possible and in no case after the hives are removed from the property.

In the event of any unsettled dispute between the Beekeeper and Grower both parties agree to abide by the decision of a mutually agreed upon independent arbitrator.

ASSIGNMENT OR TRANSFER

This agreement is not assigned or transferable by either party, except that the terms hereof shall be binding upon a successor by operation of law to the interest of either party.

This day _____ of _____ 20 _____

IN WITNESS THEREOF, the parties hereto have executed this agreement the day and year above.

<p>Grower Signature: _____</p> <p>Grower: _____</p> <p>ABN: _____</p> <p>Grower Address: (Correspondence) _____</p> <p>_____</p> <p>(Delivery) _____</p> <p>_____</p> <p>Contact details:</p> <p>(Site manager) _____ (Mobile) _____</p>

<p>Beekeeper Signature: _____</p> <p>Beekeeper: _____</p> <p>ABN: _____</p> <p>Address: (Correspondence) _____</p> <p>_____</p> <p>(Delivery) _____</p> <p>_____</p> <p>Contact details:</p> <p>(Name) _____ (Mobile) _____</p>
--

(One signed copy each to be retained by the Grower and by the Beekeeper)

12. Letter to Neighbours Template

Date

Dear Neighbour

Re. Notification of the presence of bees and compatible farming practices to protect honey bees

As you may already know, thousands of honey bee hives are delivered to pollinate berry crops across Australia every year.

Honey bees are an important part of berry production as their pollination activities contribute yield and quality to the crop. Honey bee hives are required by growers at regular intervals throughout the year.

Honey bees are very sensitive to pesticides and for this reason, we modify or discontinue our usual spray programs to protect bees during their stay in our farm.

As you are a valued neighbour, we are letting you know how the honey bees may affect you.

Firstly, bees could fly to your property in the search of extra food or water for their hives. This is more likely to occur in the afternoons when pollen and nectar have already been collected from the viable berry flowers. We trust the bees will not be a nuisance however if they are causing concern, please ring me _____(mobile).

Secondly, bees may be affected by the sprays used on your property especially when spray drift and/ or inversion layers occur. We ask if you can help us by reviewing your spray programs and farming schedules and consider potential risks to bees during the pollination season.

I am more than happy to answer any questions you might have on this and to provide suggestions and recommendations on alternative bee-friendly sprays, application methods, and timing.

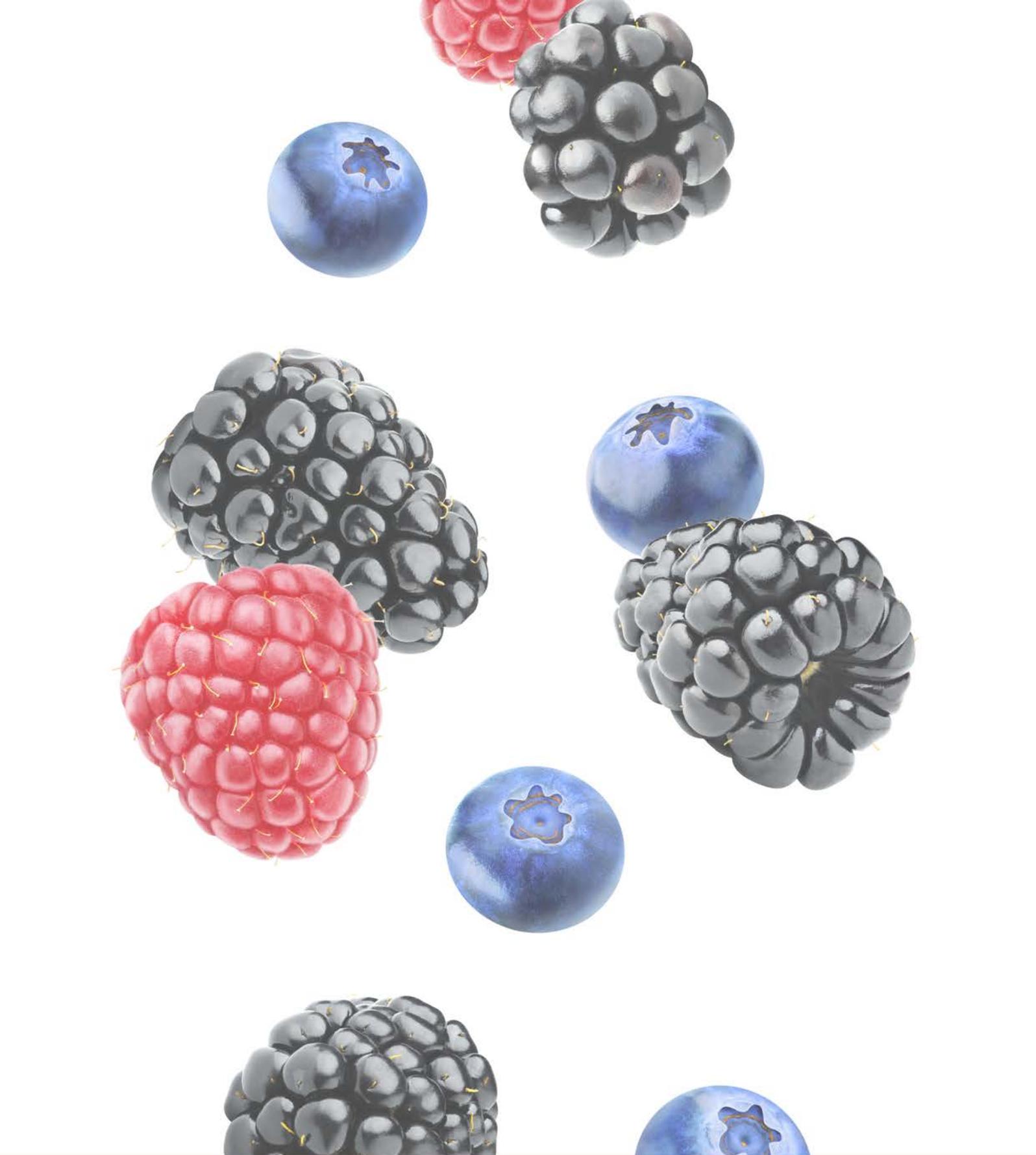
I will follow up with a reminder on the above just before the first bees arrive on farm. In the meantime, if you have any questions, please contact me on _____(mobile).

We look forward to hearing from you and working with you to keep all bees safe, healthy, and active this pollination season.

Kind regards

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