



Beekeeping Certificate III
Participants Learning Guide

**RTE2144A Carry out livestock observation
(bees)**



Australian Government

**Department of Agriculture,
Fisheries and Forestry**



**Australian Honey Bee
Industry Council**

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What this learning guide covers

This learning guide will help you meet the requirements of the unit of competency:

- *RTE2144A Undertake livestock observation*

You may also wish to undertake the following units of competency:

- *RTE3155A Manipulate honey bee brood.*
- *RTE333320A Remove a honey crop from a hive*
- *RTE3407A Identify and report unusual disease or plant pest signs.*
- *RTE3154A Requeen a honeybee colony*
- *RTE3415A Manage pests and diseases within a honeybee colony.*

Resources you will need for this unit

For this unit of competency, you should have:

- Participants Learning Guide (this booklet)
- Participants Assessment Worksheet
- a beehive with bees
- an experienced beekeeper
- tools and equipment:
 - protective clothing
 - bee-proof overalls
 - socks and gloves
 - steel capped boots/shoes
 - sunhats
 - bee veils
 - sunscreen lotion
 - bee smoker (lid, barrel, bellows and a heat guard)
 - smoker fuel (such as pine needles, clean Hessian bag)

- newspaper (to start the smoker)
- box of matches or cigarette lighter
- hive brush
- hive tool to open and close the smoker lid
- empty bee box and or clean lid
- bucket of water and soap with towel
- fire proof box for smoker
- bee blower and or bee escape boards if removing honey.
- super cracker
- loaders
- queen excluder
- vehicles
- wheelbarrow
- knapsack spray pump with tank:
 - capacity of not less than nine litres
 - fully charged with water
 - complies with Australian Standard 1687–1991
- one rake hoe or similar implement capable of removing grass, shrubs, vegetation and other flammable material from fire area.
- soapy water to clean the smoker bellows and hive tool after use
- binoculars

Note: you may need other tools and equipment depending on the other beekeeping tasks you are going to be doing.

The Participants Learning Guide is designed to introduce the topics and to provide you with some practical and written activities which will allow you to develop both your knowledge and skills in each area.

The Participant Assessment Worksheets include activities that you will be completing as part of your formal assessment for this unit.

Please record as much detail as you can as your responses to these activities will form part of your assessment.

You will need to send the Participants Assessment Worksheets to your assessor. Check with your assessor to find out if they need you to submit this Participants Learning Guide as well.

Introduction to this unit

In this unit, you will learn about:

- preparing to work with bees
- checking your bees
- dealing with emergencies affecting your bees
- sources of support and help.

Before you start this training you should be confident about your skills to:

- handle bees
- identify signs of disease, pests or poor condition.

You should know about:

- the range of diseases and pests that may affect bees
- the application of a range of basic treatments
- bee behaviour
- the enterprises production and management plans
- sound management practices and processes to minimise noise, odours and debris
- relevant codes of practice, legislation and regulations relating to waste and environment management.

Why this task is important

Probably the single most important skill a beekeeper needs is observation. A beekeeper needs to observe bees to know how they act under different floral resource rewards, climate conditions and the appropriate actions to take.

1. Preparing to work with bees

Getting ready

As a beekeeper, your daily work routines will give you many opportunities to observe your bees.

Sometimes, you may need to check hives for a particular reason, for example to see if the honey crop is ready to be removed or to look for signs of disease or pests. As well as being prepared to carry out beekeeping tasks by having all your tools and equipment ready to use, you may need to make a record of what you have observed or done. For example, you might be asked to note down how much of each frame in the super is covered with capped cells of honey or make a general comment about the condition of the colony.

Activity

What tools and equipment must you always have ready to use for beekeeping work?

Activity

Ask your supervisor what you might need to record about what you observe. Make a note in the space below.

Occupational health and safety

You need to be aware of possible risks to you and others which can include:

- bee stings
- dust
- airborne and soil micro-organisms
- fire
- holes in uneven surfaces
- noise
- incorrect manual lifting
- wildlife, including snakes
- domestic stock
- solar radiation.

Activity

What do you think are the most likely OHS hazards that might occur while you are observing bees in the field?

What can you do to prevent this?

2. About bees

Castes of bees

When you are checking your bees, you need to be able to recognise the different castes or types of bees in the hive.

In every hive there are three castes:

- a queen
- workers
- drones.

The queen bee

The queen is the largest bee in the colony and can be up to 20mm long. Her abdomen is longer and shinier than that of the other bees. The queen may also be absent, either because she is mating, has died or led a swarm to set up a new colony. Depending on why the queen is absent, the bees will be behaving differently.



The queen bee is groomed by her attendants.

Source: NSW DPI

The worker bee

Workers are the smallest bees in the colony. They are all female and will carry out different tasks. The main factor controlling the type of task worker bees do is the development of glands producing secretions for the required task, not the age of the bee. There will always be worker bees in the colony.

The drone

Drones are noticeably larger than the worker bees. They have rounded abdomens, huge compound eyes and powerful wings. Their sole task is to mate with the queen. Once the drone has mated, he dies. Drones are present generally only between spring and autumn.

Therefore, depending on the time of the year, you may see all the castes or only the workers.

How long do bees live?

Queens can live up to 4 years but are replaced every 1-2 years; drones are only present when the colony wants them. A worker's lifespan depends on how hard she works and the protein content of the pollen and amount she eats; it can be as short as 4 weeks.

How many bees are there in a colony?

Strong double hives consists of 45,000 to 50,000 workers with eight or more frames of brood; hives can have over 80,000 workers in peak production period.

Bees are required to keep the brood temperature between 34°C - 36°C with a relative humidity of 90-95%.

3. Observing bees in the field

Equipment

Binoculars are an essential piece of equipment as blossoms and bees can be observed working tall eucalypts trees and other flora difficult to get close to.

Observing bees and flora

Bees are attracted to a wide range of plants: trees; shrubs; crops; and weeds, that reward the worker bees with nectar, pollen and propolis.

By observing the bees' behaviour, you can judge what rewards they are collecting for their hive. It is very important to be able to read correctly what is happening in the field, because as a beekeeper from time to time you may need to move your hives to provide the best conditions for the bees and so get the best financial rewards from them.

Plants, trees, scrub, crops and weeds can reward bees at different times of the day with nectar and or pollen. This also varies under different climate conditions. So you need to look at flora during daylight hours at different times of the day to see if bees are actively visiting the flowers.

If you look at flowers and bees are not present, it means at that time the flowers have no rewards for the bees, that is there is no surplus nectar or pollen. Some plants flower and never have a reward for bees, for example oleanders. If bees are present on the flowers but moving quickly from flower to flower, it means the reward for them is poor.

Some flowers yield both surplus pollen and nectar, for example Spotted Gum and Paterson's Curse, while others yield only nectar, for example Yellow Box and Mugga Ironbark.

Observing pollen collecting

Pollen provides a rich source of protein for bees that they use for breeding and increasing their life span.

Pollen is produced on the anthers of a flower. If bees are working the anthers of the flowers, it means pollen is being produced. By observing the field bees collecting pollen, you can tell how quickly they are collecting the pollen.

Pollen is powdery and can be any colour and is carried on the bees' hind legs, with some often found on the body hairs. The pollen from each plant is like a

finger print and can be identified under a microscope and typed to a particular plant.

A lot of research has been done on the protein content of pollen, so by identifying the plant you can get an idea of the protein value of the pollen, for example Radiata Pine, (*Pinus radiata*) pollen has a protein content of about 4% where as Paterson's Curse (*Echium plantagineum*) has a protein content up to 40%. Unfortunately, bees cannot tell the protein content of particular pollen and they are very attracted to low protein pollen such as Radiata pine as well as to a high protein pollen like Paterson's Curse. The higher the protein content the better, however volume collected also has to be considered.

Also by observing the pollen baskets on the hind legs of the bees you can see the size of the load. The larger the load the better as it means plenty of pollen is available.

By looking closely at the anthers of the flowers you can see the pollen. Pollen collectors are more active in the morning.

Observing nectar collecting

Bees collect nectar from the nectaries of flowers. Nectaries are usually located at the base of the flower.

The bee lands on the flower and if the nectar is attractive to bees, she will use her proboscis or tongue like a straw to suck up the nectar at the base of the flower.

The bee will stay on the same flower for a long time if there is plenty of nectar available.

The yield of nectar can vary greatly from different species and under different conditions. In exceptional years, 1000 hectares of Spotted Gum (*Corymbia maculata*) forest flowering from April to August could yield five tonnes of honey.

Winter-flowering Spotted Gum appears to maximize nectar production when conditions are unsuitable for growth, such as when it is dry or cold, while slower growing Grey Ironbark, (*Eucalyptus paniculata*), which can flower in a variety of seasons, appears to yield its richest nectar in summers that are warm and moist.

If very little nectar is available, the bees will move quickly from flower to flower. When nectar is plentiful, the bees walk from flower to flower. If you cannot observe bees in the area, you can collect some flowers and hit them on the windscreen of your vehicle. If nectar is present, some will be thrown out and stick on your windscreen. You can tell if it is nectar by its taste.

Nectar can be present and observe by you at flowers but the bees may not work it as the sugar content is not attracting bees but may attract other insects and birds bees prefer 36% sugar concentration honey eaters 22% bats 19%

Sugar concentration is lower in the morning and in most plant species increases during the day.

The nectar collected from different species varies in moisture content and the resulting honey varies in colour, density and flavour.

If bees are attracted to very high moisture nectar, it can ferment and kill the collecting field bees. These can be observed showing drunken characteristics on the ground under the flora they are working, due to the high yeast activity in the nectar. This can be a common problem with some autumn, winter flowering eucalypts, such as Swamp Mahogany and Mugga Ironbark.

Climatic conditions also can stop bees working flora. If rain occurs on River Red Gum, it will stop yielding nectar. Most ground flora yields best in humid weather e.g. Clover, Lucerne.

Insects can repel bees from collecting nectar and pollen for example, thrips and Bogong moths.

Honey dew

Bees collect some honeydew that comes from insects of extra floral nectaries found on some plants, especially cotton. Bees collect it in a similar way to honey, but when ripened by the bees the final sugar is different to honey. Very little is produced in Australia.

Propolis

This is a gum-like substance that is collected from a wide variety of plants with good antibiotic characteristics and is used by bees to block up cracks and polish cells. It is collected by the field bees mostly in autumn but can be collected all year round. It is carried back to the hive on the bee's pollen

baskets and is usually a brownish colour bees. When there is little to be collected, the bees collect paint, tar and other sealants used around windows.

Water

In hot weather over 40°C, each colony may collect up to 4 litres of water each for use in the colony. Bees can be observed collecting water at dams, puddles and river banks. They suck up the water with their tongues and carry it back to the colony in their honey sac. Water is used to control the humidity at 90-95% inside the hive and for the bees to drink.

Beelining

The following formula can be used to tell how far and how long it takes a bee to fly from one point, visit a floral source or obtain water and return to the start point.

Distance (in metres) = time x 150 – 500

For example, say a bee takes 5 minutes and 13 seconds (approximately 5.25 minutes), then:

$$\begin{aligned}\text{Distance} &= (5.25 \times 150) - 500 \\ &= 787.5 - 500 \\ &= 287 \text{ metres}\end{aligned}$$

Therefore the bee is making a round trip of about 287 metres.

Robbing

If there is a little nectar, water, pollen or propolis, bees will be attracted to substitutes, except for water.

If nectar is in short supply, masses of bees can be observed sucking up any exposed honey that has been spilt and trying to gain entry to hives that are open. Bees will also try to collect sugar-based drinks, visit sugar cane mills and spilt fruit, especially grapes.

If pollen is in short supply, particular in autumn, bees will visit stock food mills, feed lots, poultry farms and piggeries where protein is fed, especially pollard and bran.

If propolis is short, bees will collect tar, paint or sealants used around windows and guttering.

If bees are short of water and a beekeeper turns up, they will try and collect sweat, or if water is spilt, huge numbers of bees will turn up to collect it.

4. Observing bees outside the hive

The more active the flight the better is the reward for the worker bees in the field.

Bees on the same field trip usually collect the same product, in other words the same bee will only collect pollen while another bee collects only nectar even though they come from the same hive.

Sit close to the hive entrance and observe.

Bees collecting pollen will have pollen in their pollen baskets on their two hind legs and also may have pollen on their body hairs. The larger the loads the better and the more colours the better. Bees collecting nectar or water often land short of the hive entrance with extended abdomens as the honey stomach is full of fluid. You can catch a bee and gently squeeze the abdomen so that the bee regurgitates the contents through her mouth. You can taste this. If sweet, it is nectar, if not, water has been collected.

Bees collecting propolis will have it carried on the hind legs and is usually a brownish colour. It can be confused with pollen.

The male drone can also be observed at the entrance in times of prosperity, usually from September to March.

You may also observe a queen returning from a mating flight if the hive is being requeened through a queen cell.

If you observe over half a handful of dead or dying bees, you should investigate the cause. It could be a sign of disease, pesticides, fermenting honey or robbing bees fighting.

European Wasps may also be observed trying to gain entry or attacking the bees at the hive entrance. This can cause the bees to become very aggressive as the guard bees attack them.

You will observe some bees fanning at the entrance. These bees are air-conditioning the colony to maintain the hive brood temperature between 34°C - 36°C.

You may observe the guard bees checking the incoming bees. If any don't belong to the hive and are acting as robbers, the guard bees will attack them.

In times of short supply, if hives are weak or have been opened by the beekeeper, robber bees will try to gain entry through the entrance, any cracks or holes in the super. They may mass in large numbers where the lid or supers join as they can smell the honey but may not be gaining entry.

You can compare flight between hives in the apiary. The more bees that are flying at the hive entrance, the stronger the hive. If you observe pollen being collected but notice that bees from one hive are not collecting pollen, it can indicate this hive is queenless and doesn't have a demand for pollen for brood rearing. In hot weather, strong hives have large clusters of bees at the entrance.

Dancing bees

Bees dance to indicate and recruit bees to collect water, propolis, pollen and nectar by providing information about distance and direction of food source relating to the sun and hive position.

In the case of nectar, the bees regurgitate the nectar from their honey sac and provide the new foragers with their smell and taste of nectar produced by the plant they will be seeking.

5. Observing bees inside the hive

When you remove the lid, you will observe bees on the frame top bars and walking on the face of the combs and on the lid and inner cover.

Remove the frame and observe what the bees are doing. Depending on the needs of the colony, different groups of bees do different jobs.

In a healthy active colony, you should observe the following:

- bees fanning on the comb surface to air-condition the colony to keep the brood temperate correct
- bees with pollen on their pollen baskets. These bees will kick off the pollen and stamp it into a cell.
- bees with bloated abdomens unloading nectar through their mouths or tongue to other bees for ripening into honey
- bees with heads in cells depositing nectar for the ripening process to be completed. Once completed other bees can be seen placing a wax cap over the cells.
- bees placing water in cells for cooling when required
- bees using propolis to block up holes and cracks in boxes, between the lid and supers and sometimes to reduce the entrance opening
- bees feeding the brood with royal jelly using their mouth parts and tongue with others capping the brood cells
- bees on comb foundation secreting wax to draw the cells or build brace or burr comb
- the queen on the comb surface being feed by the workers
- you may see the queen with her abdomen in a cell laying eggs
- you may see some bees carrying out adult bees that have died in the hive or removing dead brood such as Chalkbrood mummies
- drones on the comb being fed by the workers.
- bees feeding on nectar or pollen with their heads in the cells

- in winter, bees clustering together to keep warm
- drones and workers emerging from the brood cells
- you may see queens emerging from queen cells.

When observing bees, always check them for and parasites and the health of the developing brood.

At night

In very hot weather or when bees are on honey flow, bees actively fan at night to cool the colony or ripen the days collection of nectar.

Nectar often has a strong fragrance and this can be smelt when you get close to the apiary as well as hearing the noise of the bees fanning. This is a strong indication the bees are on a honey flow. The longer the fanning, the thinner the original nectar had been. Thin nectar stimulates brood rearing provided pollen is available, comb building and good swarming in spring. Hive with strong colonies will have a large cluster of bees at the hive entrance most of the night.

6. Dealing with emergencies affecting your bees

There is often a lot of importance placed on preparing yourself to cope with unexpected events and emergencies. You may also need to deal with emergency situations affecting your bees. These might include:

- drought and lack of water
- bushfire
- flooding
- truck accident
- robbing of protein stores.

You might have advance warning about some of the situations; in other cases, you may be caught unprepared.

Activity

For each of these situations, discuss with your supervisor what you should do beforehand to deal with the situation should it occur, for example, what preparations should you make so that you can deal with your bees in the event of an accident involving your truck. Make a note in the space below.

7. Sources of help and advice

There are many sources of help and advice available to you:

- apiary officers provide advice on the general day to day management of your bees and with identifying and managing diseases and pests
- regulatory officers provide advice on export and interstate movement requirements
- honey packers can provide information and advice about their requirements and on best practice in producing honey to meet market expectations.
- beekeeping associations and fellow beekeepers are also sources of advice on dealing with beekeeping problems and may be able to help out in an emergency, such moving bees after a truck accident
- research organisations, such as the Rural Industries research and Development Corporation, CSIRO and universities have information on many areas of interest to beekeepers.

Final activities and assessment

Now that you have completed all the activities in this Learning Guide, take some time to observe bees under a wide variety of conditions.

When you are ready, you can complete the assessment tasks that are listed in the Participants Assessment Worksheets for this unit of competency.

Useful references

Bee Agskills: A Practical Guide to Farm Skills, 2007, NSW Department of Primary Industries.

The Bee Book: Beekeeping in Australia, 2nd edition, 2005, Peter Warhurst and Roger Goebel, Queensland Department of Primary Industries and Fisheries.