



**Beekeeping - Certificate III  
Participants Learning Guide**

**RTE3321A Extract honey**



**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:

- *RTE3321A Extract honey.*

You may wish to undertake the following additional units of competency that are also relevant to extracting honey:

*FDFCORFSY2A      Implement the food safety program and procedures*

*FDFCORQAS2A      Implement quality systems and procedures*

*FDFOPTHCP3A      Participate in a HACCP team*

*FDFZCSCIP2A      Clean equipment in place*

*FDFZCSCS2A      Clean and sanitize equipment*

*RTC2301A          Undertake operational maintenance of machinery*

*RTC2307A          Operate machinery and equipment*

*RTE3901A          Comply with industry quality assurance requirements*

## Resources you will need for this unit

For this unit of competency, you should have:

- Participants Learning Guide (this booklet)
- Participants Assessment Worksheets
- standards for extracting honey, such as those included in B Qual or Bee Safe
- an experienced beekeeper or someone to help you
- tools and equipment:
  - frames with honey
  - uncapping knife (electric or hand-held)
  - hot water or steam for the knife
  - a honey extractor appropriate for the scale of operations

- equipment to filter, strain or settle foreign particles out of honey
- depending the equipment you are using, you may also need:
  - container or bucket to catch the wax cappings, with something to rest the frame on while you are uncapping
  - bucket to catch the honey as it is being extracted
- bee proof overalls and gloves
- hair net
- ear protection
- suitable non-slip boots or shoes
- hand washing facilities or bucket of water and soap with suitable towel (e.g. paper or disposable).

**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. 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.

### **Important safety note**

If this is the first time you are extracting honey, ask an experienced beekeeper to show you what to do and to be on hand to help you in case you need an extra pair of hands.

## Introduction to this unit

### **In this unit, you will learn about:**

- equipment for extracting honey
- preparing to extract honey
- extracting honey
- settling honey
- storing honey.

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

- distinguish between honey cells and brood cells
- judge when combs are ripe
- safely use equipment to extract honey.

### **You should know about:**

- food safety systems and requirements
- requirements of honey bee industry quality assurance programs such as BQual.

# 1. Preparing to extract honey

## Why this task is important

Bees can be kept to produce products other than honey but the majority of beekeepers keep bees for honey. All beekeepers need to know how to extract honey from their combs.

Before extracting your honey, you need to consider the following:

- where you will be extracting honey
- the equipment you need
- the timing of the extraction
- quality assurance and food safety requirements
- occupational health and safety
- other special requirements, for example, for organic honey.

## Where do beekeepers extract their honey?

Honey extracting may be done in a mobile van or purpose-built fixed facility, such as a honey shed.

All facilities, mobile or fixed, that are used to extract honey for human consumption must meet local government regulations for food processing premises.

These regulations may vary from council to council so you will need to check what your local council requires.

Pest control is very important round the building. Many beekeepers use bait stations. Your mobile unit or building should also be bee-proof as swarms and robber bees will be attracted to honey.

For more detail, see Work Instructions 08 in the BQual Manual.



Commonly-used equipment includes:

- a hot room
- uncapping machine or purpose-designed hand-held knife, heated by hot water, steam or electricity (see Figure 41 on page 63 of Bee AgSkills)
- a honey extractor to remove the honey from the uncapped combs
- capping spinners to separate honey and wax cappings
- sump or other vessel to hold the honey spun out of the combs and separated from the wax cappings.
- capping scratcher
- pumps or other means to transfer honey to the centrifuge and/or the storage tank
- strainers to remove large particles of beeswax and foreign matter
- storage tank to hold honey
- suitable containers to store honey longer term or to use when transporting honey to a packer, for example, drums or intermediate bulk containers (IBCs)
- honey and wax draining trays
- wax moulds
- buckets.

### **Hot room**

Most commercial-scale beekeepers use a hot room to lower the viscosity of the honey. This increases the flow rate of the honey and so helps extract it from combs. The hot room is heated by electric elements; the hot air is circulated by fans around the supers. Supers are left in the hot room until the honey in the combs reaches 35°C.

### **Uncapping machine**

This is a specially-built stainless steel machine that uses two vibrating spring-loaded knives to uncap both sides of the comb at the same time. The cutting depth is adjustable. The blades are heated by steam or hot water. Uncapping

machines are chain-driven with forward and reverse controls. They are powered by an electric motor. An uncapping machine can uncap about eight frames a minute.

They are very popular with both commercial and sideline beekeepers.

### **Hand-held knives**

There are four types of knives that can be used. Skilled operators can uncap 1-3 combs a minute with a hand-held knife.

Depending on the design, hot water-heated knives are immersed in hot water or hot water is circulated through a jacket in the knife.

An electrically-heated knife is heated by an electric element for continuous use.

A steam knife has a jacket which circulates steam, also for continuous use.

### **Honey extractors**

Extractors use the principle of centrifugal force to remove honey from combs. They consist of a drum with a reel inside to hold the frames. Frames are placed on the reel that is rotated at speed to spin the honey out of the uncapped cells.

They are made of food-grade plastic or stainless steel. Older extractors were made of galvanized iron and mild steel. If you are using one of these older extractors, it must be painted with a food-grade covering, usually a two-part special paint.

#### Size of extractors

The capacity of extractors varies from very small ones that will extract only one frame at a time right up to the very largest extractors that can deal with over 180 frames in the same load.

The size of the extractor you buy will depend on the number of hives you own.

If you have up to 50 hives, a two, four or nine frame extractor should be suitable. The more hives, the larger the extractor is better!

Honey extractors are described by the design and the number of frames they hold. Common types are:

A single frame slinger extracts one frame at a time and is hand operated. (See Figures 43 and 44 on page 64 of *Bee AgSkills*)

Two, three and four frame hand-operated non-reversible extractors are the next size available. To extract the honey from both sides of the frame, the frame must be removed and turned around so that the side to be extracted faces the wall of the drum.

The more sophisticated version of these extractors has baskets that hold the frames. These swing to reverse the frames so you do not have to remove them from the baskets to extract both sides of the combs. These reversible extractors can be either electric-powered or hand-driven.

A 2 frame hand-driven extractor can be held while extracting. Larger extractors must be bolted to the floor, as must all electric-driven extractors.

Semi-radial extractors are fitted with baskets that swing so both sides of the combs can be extracted when the baskets are turned. The baskets are at an angle to the drum so more frames can be extracted in the same diameter extractor compared with using a non-reversible extractor. These come in sizes of 9 frame, 12 frame or 21 frame. Special double baskets are available that can increase the frame capacity of these extractors. All are power-driven by electric motors.

In radial extractors, the frames fit into frame holders so that when the reel is spun, both sides of the comb are extracted at the same time. The diameter of the drum is utilized to the maximum with this method. The reels can spin either horizontally or vertically, taking 180 or more frames. Some types of radial extractors can be loaded with frames and unloaded by pushing the frames in and out using a conveyer, whereas other types require you load and unload all the frames by hand.



A few commercial beekeepers use this method but it is very uncommon due to the longer time required to extract and clean the final product. Careful use of heat will not impact on honey quality.

### **Timing**

Check that at least two-thirds of each comb is sealed.

The moisture content must be low enough to avoid fermentation, less than 20%.

Honey should be extracted as soon as possible after the frames have been removed from the hives.

It is very important that all honey from hives where small hive beetles have been present is extracted within two days of removal of the combs from the hives. This is to prevent any small hive beetle damage to the honey.

For more information, see Work Instructions 05 in the BQual Manual.

### **Food safety requirements and quality assurance**

During extracting, you must be aware of and address any hazards, including chemical hazards, physical hazards, biological hazards and other hazards, that may affect the quality and food safety of the honey.

The Food Safety Australia and New Zealand (FSANZ) Standards require the food producer to have systems in place so that they can participate in a product recall. A batch of recalled food must be able to be identified and isolated so that it may not be sold. To achieve this, you must have a recall protocol in place and take and retain samples of each batch of honey you extract. Quality assurance programs, including BQual, usually specify how samples must be taken and stored.

You will find more information about taking a sample later in this Learning Guide.

### **Food safety programs**

It is important to put in place a food safety program that documents how you will minimize the health risks associated with producing and extracting honey. The program must be based on an understanding of hazards, food safety practices and industry standards, and include details of who is responsible for

what and the records that must be kept. B-Qual and B-Safe offer specific training for beekeepers to implement a food safety program.

For more information about quality assurance and food safety, you can undertake the unit of competency *RTE3901A Comply with industry quality assurance requirements*.

### Cleaning and sanitising

All surfaces that honey comes into contact with during the extracting process must be cleaned carefully after each extraction. The owner or manager must document the cleaning requirements and these instructions should be displayed in the extracting room. All surfaces should be checked prior to starting the next extraction and if not up to standard, cleaned again.

Water used in the sanitising process must be hot – unfortunately how hot depends on which state or territory you are working! Food safety regulations in each state will specify the temperature required. All equipment must be dry before use because any moisture or dampness can cause the honey to ferment.

For more information, see Work Instructions 07 in the BQual Manual.

### Personal Hygiene

As you are handling food, you must meet standards of personal hygiene. These are simple:

- maintain personal cleanliness
- wear clean protective clothing and head covering
- do not wear jewellery
- use blue bandaids to cover open wounds or scratches
- wash hands with unscented germicidal liquid hand soap and dry hands before starting to extract.

For more information, see Work Instructions 06B in the BQual Manual.

### **Occupational health and safety**

OHS hazards related to extracting honey may include:

- bee stings
- incorrect manual handling

- slippery and uneven surfaces
- sharp tools and equipment
- burns from hot knives
- belt drives
- steam or hot water pipes
- moving chains and other machinery parts.

**Other requirements**

The standard for organic production in Australia is *The National Standard for Organic and Biodynamic Production*. The Australian Quarantine and Inspection Service (AQIS) administer the standard.

For more detail on Organic Honey Production, see Section 3 of the BQual Manual.

## 2. Extracting honey

The details of how honey is extracted will depend on the specific equipment you are using, but there are some general principles that you should follow.

The usual sequence of activities is:

- remove frames from supers
- visually inspect frames
- uncap the cells
- place the uncapped frames into the extracting unit
- operate the extracting unit
- remove the extracted honey to a storage tank or container
- remove the wax and other by products and waste
- clean up.

### **Remove frames and inspect them**

The supers to be extracted are moved into the extracting area.

The frames are removed from the supers and inspected to ensure they are free of brood and the honey is ripe.

### **Uncap the cells**

The caps are removed from the sealed honey cells using an uncapping machine or a hand-held knife.

The uncapping of cells exposes the honey that then can be extracted without damaging the comb.

When uncapping with a hand-held knife, hold the comb on an upward projecting stainless steel screw so you can rotate the frame without lifting it to uncap both sides of the frame. The cappings can drop into a tray below. (See Figures 42a and 42b on page 64 of *Bee AgSkills*)

Grip the frame with the thumb lying along the end bar and use the knife to cut downward, and with a sawing motion, shave off the cappings. Always cut down. If you cut up, you risk cutting your thumb if the knife slips. Not only will you hurt yourself, but you may contaminate the honey.

Depressions in the comb that are missed with the knife can be uncapped using a capping scratcher. These are available from a beekeeping equipment supplier.

Whatever method you used to remove cappings, cut back to the wood on the top and bottom bars. This keeps the combs an even thickness so they fit back neatly into the supers.

It is important the knives are hot (around 45°C) so as to avoid damaging the cells and frames. If they are too cold, they will tear the cells.

The uncapped combs of honey then are ready to be placed into the extractor.

The wax cappings fall into a suitable container or are pumped with the honey if a centrifuge is used. Some producers use a reducer that heats the honey and wax to separate them; other beekeepers strain the honey from the wax and heat the cappings later to make blocks of beeswax. Others use a capping spinner.

#### **Place frames into extracting unit and operate the unit**

Place the frames into the extractor.

Some combs will be heavier than others, so when you are loading the frames, try to balance the load by spreading the weight evenly around the reel. If it is unbalanced, the extractor will rock too much when the reel is rotated and the honey may not be extracted completely.

The smaller the diameter of the extractor, the faster it has to be turned to extract the honey. Combs can be damaged during extracting, so start off hand extractors slowly, gradually increasing the speed until you can see the honey being extracted. After a minute, take the combs out and replace them with the other side facing the drum wall to extract some honey from the other side of the comb. Keep reversing the combs until all the honey is extracted. Doing this in a slow but steady way will help to prevent comb damage.

Larger extractors often have a variable drive, going slowly at the start to avoid comb damage; they can speed up when most of the honey is extracted. New combs are the easiest to damage.

It is important to rotate the reel at the speed recommended by the manufacturer to ensure combs are not broken.

As honey is spun out of the combs, in the smaller extractors it runs down the side of the drum to a honey gate and in the larger ones it goes through an outlet into a sump. Larger extractors have a jacket built into the extractor reel to warm the honey as it runs over to make straining easier.

The density of the honey will determine how long you will need to spin the reel so that most of the honey is removed from the combs. You can judge when all the honey is extracted by the weight of the combs and by looking at them. If the extractor cover is Perspex, you can see when the honey stops hitting the extractor drum when the reel is rotating.

In most situations, extracting is a straight-forward operation. On occasion, the speed time may need to be varied depending on the density of the honey but you can work this out by trial and error.

Some honey always stays on the cell walls, hence the term used to describe combs that have been extracted – ‘stickies’.

Once all the honey has been extracted, the frames are ready to be put back in the supers for returning to the hives to be refilled by the bees or stored for later use. This is a good time to cull sub-standard combs. You should remove combs with broken frames or wires, broken combs, excess drone comb and old, black combs.

### 3. Settling honey

Extracted honey contains particles of wax, pollen and air bubbles. Honey should never be sold in this condition to the public. Several methods can be used to remove such particles.

#### **For small quantities**

##### Settling

Place all the extracted honey into a honey bucket with a gate at the bottom raised 50mm from the base. Place a lid on the honey bucket.

Allow the honey to sit for a couple of days.

All light particles will float to the top where they can be skimmed off and the heavy particles will fall below the bottom honey gate outlet.

The clean honey is removed through the honey gate after a couple of days settling.



*Honey 'buckets' come in a variety of sizes to suit the size of operations.*

*Source: Bruce White*

##### Straining

Another effective method is to heat all the honey to 49°C and allow it to pass through a fine mesh strainer into a honey bucket with the gate in the bottom. Suitable strainers are available from a beekeeping supplier.

At this temperature, the honey is not over-heated, is quite thin and can be easily strained.

If any foreign particles pass through the strainer, they rise to the top of the bucket.

The clean honey is removed through the honey gate after a couple of days settling.

### **For commercial quantities**

With commercial quantities of honey, the extractor will have a heated coil to warm the honey, as well as a heated sump.

After extraction, the honey is pumped to a stainless steel storage tank fitted with a strainer.

The honey passes through the strainer and is then allowed to settle for at least 12 hours before being removed by the bottom honey gate into bulk storage containers.

Other commercial producers use a honey centrifuge. The honey and wax is pumped through a heat exchange that heats the honey and wax and cleans and separates the honey from the wax.

The honey is then pumped into settling tanks and then into bulk containers.

### **Honey colour**

Bees collect nectar from a wide variety of plants and so the resulting honey can vary a great deal in colour. The colour of honey can be measured by an instrument called a Pfund grader.

On the world market, honey is traded based on colour and some domestic honey packers pay beekeepers mainly on the honey colour. The lighter the colour, the more valuable it is to the beekeeper when sold to a honey packer. The lower the Pfund reading, the lighter the colour:

| <b>Grade</b>      | <b>P-fund reading</b> |
|-------------------|-----------------------|
| White             | up to 34mm            |
| Extra light amber | 34mm to 48mm          |
| Light amber       | 48mm to 65mm          |
| Pale amber        | 65mm to 83mm          |
| Medium amber      | 83mm to 100mm         |
| Amber             | 100mm to 114mm        |
| Dark amber        | above 114mm           |

## 4. Storing honey

Honey is hygroscopic, that is, it will absorb moisture from the atmosphere or damp surfaces that it comes into contact with.

It is the moisture in honey that causes fermentation to begin. This can seriously affect the quality and longevity of your product. The following table shows the World Health Organization's requirements for the composition of honey:

|                         |   |
|-------------------------|---|
| Glucose and fructose    | Not less than 65%                                   |
| <i>Moisture content</i> | <i>Not more than 21%</i>                            |
| Sucrose                 | Not more than 5%                                    |
| Water soluble solids    | Not more than 0.1%                                  |
| Mineral content         | Not more than 0.6%                                  |
| Acidity                 | Not more than 40 milli equivalents of acid per kilo |
| Diastase activity       | Not less than 8 on the Goethe Scale                 |
| Hydroxy methylfurfural  | Not more than 40mg HMF per kilo                     |

Laboratories and very large commercial operations may use a refractometer to determine the moisture content of honey. This is not practical for most beekeepers although some beekeepers do use them.

A simple way to test the density of honey and therefore estimate the moisture content of your honey is to place the honey in a jar, leaving a small amount of air and put the lid on it. Turn the jar upside down. The longer it takes for the bubble to rise to the 'top', the denser the honey and the lower the moisture content.



*The honey in the jar on the right is denser.*

*Source: Bruce White*

**Activity**

Using the method described above, fill three identical jars with three batches of different floral types of honey. Make sure each jar is filled to the same level, turn the jars over and record how long it takes for the bubble to rise in each jar. Record the following information for each batch:

| <b>Batch No.</b> | <b>Floral type</b> | <b>Time for bubble to rise</b> | <b>Relative density</b> |
|------------------|--------------------|--------------------------------|-------------------------|
| <b>1</b>         |                    |                                |                         |
| <b>2</b>         |                    |                                |                         |
| <b>3</b>         |                    |                                |                         |

What conclusions can you draw from your observations?

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**Good storage**

Following these principles will help maintain your honey in the best possible condition:

- reject any damaged honey containers
- clean all honey containers with hot water or steam
- drain all honey containers and allow them to dry before use
- only use food grade honey containers except 200 litre galvanized drums that can be used for short term storage until they are phased out of use
- ensure all bulk honey containers have food grade seals and are completely full
- store honey out of direct sunlight, preferably in a covered storage area where the temperature never reaches 45°C

- label the storage containers with the type of honey, floral source, date extracted and tracing identification data.

For more information, see Work Instructions 09 in the BQual Manual.

### **Taking a sample**

This is straightforward but you must follow the following rules:

- each sample must be at least 150 mls
- each sample must be retained for at least 12 months
- samples must be stored in clean containers
- each sample must be labelled with information including:
  - date of extraction
  - apiary identification
  - floral source (code)
  - batch number (if relevant)
  - identification number of the drum or IBC from which the sample has been taken.

## 5. Dealing with the beeswax

### What is beeswax?

Bees produce wax from four pairs of glands on the underside of their abdomens. Bees use wax to build their cells. Humans use beeswax for many purposes.

You can obtain beeswax in a number of ways:

- cappings, either from the uncapping process or from the extracted honey
- broken or culled combs
- wax pieces that have built by bees to fill in spaces in the hive.



*Beeswax containing capped honey (white cells at top), uncapped nectar (open cells in the centre), and brood cells (darker, capped cells toward the bottom)*

*Source: Beecare*

### Recovering wax – small scale

You can remove wax using very simple equipment:

- a strainer placed over a draining tray - put the wax on the strainer and the honey will drip through.
- a capping spinner - the honey and cappings are put into the spinner and the centrifugal force will spin the honey out.

- a capping reducer - steam or hot water melts the wax; the honey and melted wax flow into a tank, the wax floats to the top and the honey is drawn off from the bottom of the tank.

### **Recovering wax - larger scale**

Centrifuge – honey from the uncapping machine and extractor is pumped through the centrifuge. This spins off most of the honey.

The wax is then melted and poured into moulds. If necessary, you can heat the wax to 70°C and keep it at that temperature for 48 hours. This will allow you to remove any remaining dirt or debris by skimming the top and straining the liquid wax into moulds.

Paler wax will fetch a higher price so you may wish to process cappings wax separately from other wax.

After wax processing, a sticky substance will be left. This is known as ‘slum gum’. Some beekeepers send large quantities to commercial beeswax refiners to extract the final remaining wax.



*Once it is in block form, wax can be stored for an almost indefinite period of time.*

## 6. Record keeping

Some record keeping is essential, especially to comply with food safety requirements.

BQual and B-Safe both have suggested formats for keeping records. Your enterprise's food safety plan will specify what records you need to keep.

The following are some suggestions for records you might keep:

- batch numbers
- cleaning and sanitising schedule for the extracting room
- cleaning and sanitising schedule for each piece of equipment
- register of date/time of checks of containers for cleanliness and condition
- number of frames or supers extracted and their identification numbers
- number of containers filled for each type of honey
- samples collected, including identification numbers to link them to batches of honey and frames or supers
- temperature test of honey at sump
- temperature test of honey at tank or container
- moisture content of honey.

## Final activities and assessment

Now that you have completed all the activities in this Learning Guide, take some time to practice extracting honey under commonly-encountered working conditions.

When you are ready, you can complete the assessment tasks that are listed in the Participants Assessment Workbook 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 available from <https://www.publications.qld.gov.au/>, or phone 1800 801 123.

B Qual <http://www.b-qual.com.au/>

## Appendix – Food safety agencies and legislation

**Note:** You must check that you know the most recent regulations that apply in the state and/or territory in which you are working. In some states and territories, primary production enterprises are not required to comply with all the proviso of the relevant state food safety legislation.

### **National**

The following website will take you to all the relevant legislation and regulations for all states and territories:

<http://www.ausfoodnews.com.au/db/foodlaw/legislation>

### **Australian Capital Territory**

*Food Act 2001*

The ACT Department of Health administers this Act.

<http://health.act.gov.au/c/health?a=da&did=10192956>

### **New South Wales**

*Food Act 2003*

The NSW Food Authority is the NSW government agency responsible for regulating food production and food safety throughout the state. Under the *Food Act 2003*, the role of the Food Authority is to ensure that food in NSW is safe, correctly labelled and consumers have sufficient information in choosing the food they eat.

<http://www.foodauthority.nsw.gov.au/index.asp>

### **Northern Territory**

*Food Act*

The Act is administered by the Department of Health and Community Services

[http://www.nt.gov.au/health/healthdev/environ\\_health/environmental/food\\_safety.shtml](http://www.nt.gov.au/health/healthdev/environ_health/environmental/food_safety.shtml)

### **Queensland**

*Food Act 2006*

The Act is administered by the Queensland Department of Health.

<http://www.health.qld.gov.au/industry/food/>

The Department of Primary Industries and Fisheries is responsible for the *Food Production (Safety) Act 2000*

[http://www.dpi.qld.gov.au/cps/rde/xchg/dpi/hs.xsl/4790\\_4822\\_ENA\\_HTML.htm](http://www.dpi.qld.gov.au/cps/rde/xchg/dpi/hs.xsl/4790_4822_ENA_HTML.htm)

Safe Food Queensland looks after the operational aspects of food safety.

<http://www.safefood.qld.gov.au/index.php>

### **South Australia**

*Food Act 2001* and *Food Regulations 2002*

The Act is administered by the Department of Health

<http://www.health.sa.gov.au/pehs/food-index.htm>

### **Tasmania**

*Food Act 2003*

This Act is administered by the Department of Health and Human Services.

<http://www.dhhs.tas.gov.au/agency/pro/foodsafety/index.php>

### **Victoria**

*Food Act 1984*

The Act is administered by the Department of Human Services

<http://www.health.vic.gov.au/foodsafety/>

### **Western Australia**

*Health Act (WA) 1911*

The Act is administered by the Department of Health. It is being replaced.

<http://www.health.wa.gov.au/envirohealth/food/foodsafety.cfm>