Farm Production & Practice

Ministry of Agriculture and Fisheries

# Beekeeping
# Beeswax
## *Production and Processing*

**Beeswax is the main byproduct of most beekeeping businesses. Taking greater care with its salvaging and processing will increase cash returns.**

Nearly 200 tonnes of beeswax is produced in NZ annually, with about half of it being exported. The main use for beeswax is in the beekeeping industry for conversion into comb foundation. The polish and cosmetic industries are other large users.

Beeswax also has many other minor applications – for the waxing of fabrics and threads, for candlemaking, in electronic components, dentistry, etc.

### Wax secretion

Beeswax is produced by honey bees to make combs for storing honey and pollen and rearing brood. It is secreted from four pairs of wax glands situated on the underside of the abdomen of adult worker bees.

After gorging themselves with honey, workers with the most productive wax glands, i.e. those about 12–18 days old, cling together in a large cluster or festoon. Worker bees spend about 24 hours in this festoon, clinging together and producing heat, after which the wax glands of the worker bees begin to secrete wax. It is a liquid when first produced, but hardens on exposure to air to form a white flake. These flakes are removed from the glands by other workers, which manipulate them with their mouthparts and mould them into place on the comb.

Each flake takes about 4 minutes to process, and as many as 200 workers may be involved in constructing one cell. A lot of energy is required for the bees to produce wax, as at least 8 kg of honey must be consumed to produce 1 kg of wax. A high temperature must also be maintained throughout the wax production process, and this also requires energy.

### Properties

Beeswax is always white when first secreted, regardless of the food used by the bees in its manufacture. It may subsequently turn yellow as pigments from pollen are incorporated in the wax. Brood combs are darkened by accumulation of used pupal cocoons and general debris, and ultimately turn black.

Beeswax is a very stable compound and does not alter in composition at normal temperatures, even after a long time. It has the highest melting point of any known natural wax, 64°C, and has a specific gravity of 0.95.

### Sources of Wax

There are three main sources of wax for a beekeeper: cappings, scrapings, and culled combs. When processing wax, the three different types should be kept separate, as the price paid for wax depends upon its colour. Light lemon cappings wax is worth more than light orange cappings wax, which in turn is worth more than all other wax, including that from brood combs.

### Cappings

*Drying cappings:* When honey combs are uncapped, as much as one-third of the honey is removed with the cappings. Remove as much of this honey as possible before the cappings are processed, as most methods of rendering cappings taint honey.

Leave the cappings to drain in a warm place, in a draining basket or a bag made of gauze cloth. Occasional stirring of the cappings will assist drainage. The honey that drains off during this process is perfectly suitable for mixing back with the bulk of the crop.

Any remaining honey is best fed back to bees, rather than wasted. This should be done inside the hive. On no account leave cappings in the open, as this can create fierce robbing problems and is also certain to spread any ***Bacillus larvae*** spores present in the honey.

Cappings can be cleaned in several hives close to home, and there is no need to spread them out over all your hives. The simplest method involves placing the cappings in a large flat dish (such as a roasting dish) inside an empty super on top of the hive. Turn the cappings over periodically to allow the bees to gain access to the honey. Take care not to squash too many bees when doing this. When the cappings are completely dry they can be removed and dealt with as outlined under 'melting cappings'.

A much better method is to construct a simple device for holding the cappings while they are being dried (fig. 1). This can be made simply out of two old supers, or from wood cut to a similar size. Wet cappings are deposited in the top half of the equipment and bees can gain access to them through the chicken netting or queen excluder. As the

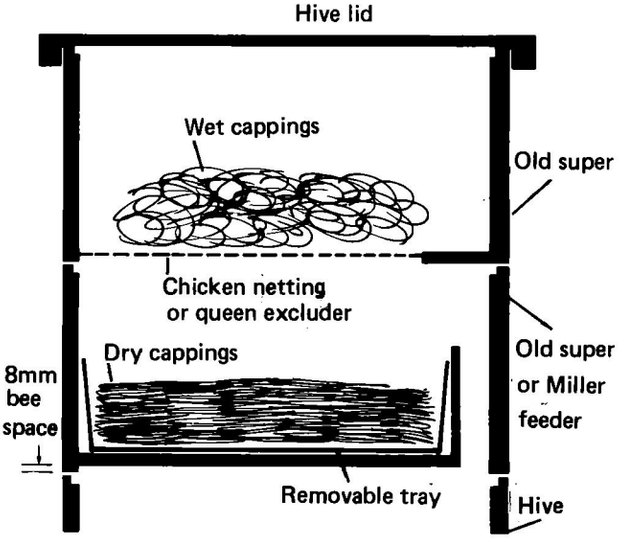


Fig. 1: Equipment for drying out cappings, on a domestic scale.

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honey is removed dry cappings fall down into the removable tray below. No visits need to be made to turn the wet cappings, and dry cappings are simply removed in the tray.

The colonies being fed with the wet cappings can be left with less honey in the brood nest than would otherwise be done, as the normal amount of winter stores may be made up by the honey removed from the cappings. This method can stimulate late brood rearing, but is still the easiest way of drying cappings on a small scale.

***Melting cappings:*** Cappings can be rendered by using a solar wax melter, or hot water, or an oven.

**Solar wax melter:** By far the easiest method for rendering cappings involves use of a solar wax melter. This consists of a wooden box containing a metal tray on which the wax sits, and a small mould into which the molten wax runs. A glass lid retains the heat, and the box is tilted at an angle to catch the sun.

As long as the basic principles are adhered to, the size of the melter is not important. It has five parts:

- wooden body;
- glass lid;
- large metal tray on which the crude wax is placed;
- piece of wire mesh to strain the molten wax;
- small pan in which to catch the molten wax.

The wooden body can be made out of 20 mm timber or plywood. It should be painted black on the outside (to absorb heat) and white on the inside (to radiate heat).

The glass lid can be based on an old window frame or can be built from scratch. In either case, it should be double-glazed, i.e., have two sheets of glass separated by a 10–15 mm gap. To prevent condensation in this airspace put some silica gel crystals in, or else drill a couple of 7 mm holes into the space through the top and bottom of the frame.

The metal tray can be made out of flat or corrugated galvanised iron, aluminium, tin, or even stainless steel. Non-galvanised iron, zinc, brass, or copper will discolour the wax and should not be used for making the tray or the mould. The metal should be formed into a tray with a spout at the lower end.

Wire mesh lining the tray filters out any impurities or debris in the wax. Finally, a mould must be provided for collecting the molten wax. Plastic or any of the metals listed above as safe may be used.

Fig. 2 shows a typical solar wax melter.The melter should be placed in a sheltered sunny position, as windy conditions greatly reduce its efficiency. If the lid does not fit snugly, seal the gap with foam strips.

A solar wax melter is cheap and easy to make and costs nothing to run. It can be used for dealing with all sources of wax. One of its main advantages is that wax can be dealt with as it comes to hand, and not left waiting to be processed in the off-season. Wax left lying about, particularly old combs, is soon destroyed by wax moth infestation. The length of the time during the year when the solar melters can be used may be limited in some parts of New Zealand.

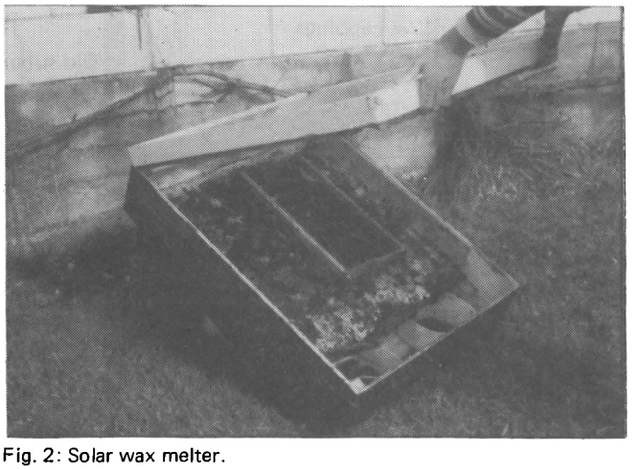

Fig. 2: Solar wax melter.

**Hot water:** Cappings which are relatively free of honey after being dried out over a hive can be melted in hot water. Fill a large vessel, such as a preserving pan, about one-third full with hot water (no more than 90°C). Add the cappings slowly so that the water does not cool down too much. On no account boil the water as this emulsifies the wax, incorporates impurities, and increases the already considerable fire danger through "spattering" of wax.

When all the cappings have melted, leave the mixture to stand until a fine film forms on the surface, to allow dirt to settle and prevent melting of plastic moulds. Then pour the wax into moulds.

A mould may be any suitable sized container made of stainless steel, tin, plastic, aluminium, or galvanised iron, preferably with tapered sides. Constrict the top of the mould slightly by tightly tying a length of string around it, with a small wooden block on each face to depress the sides slightly. When the wax has set in the mould, removal of the string and blocks will allow the sides to spring out slightly and admit air to release the suction.

A cut-down 20-litre tin may also be used as a mould if the end with the screw cap is used as the bottom. When the wax has set, remove the cap to release the suction. Cover moulds with sacks to prevent rapid cooling, which will crack the blocks of wax.

**Oven:** Cappings can be melted in a domestic oven set at its lowest temperature. Place them in a mould such as a stainless steel bowl or sink and heat gently. Some stirring may be necessary. When the wax has melted, switch the oven off and leave the wax in it to cool. Any remaining honey is usually only suitable for baking, and this method is generally inferior to the others mentioned.

**Scrapings**

Another source of beeswax is the extra wax, called burr comb, which bees build on parts of the hive woodware, and brace comb built between incorrectly spaced combs. Particularly during times of honey flow, considerable quantities of wax are deposited on the wooden frames and, to a lesser extent, on the queen excluders and insides of the hive bodies. This problem is made far worse if hive equipment is made without the correct bee spacing.

There are two reasons for removing this extra wax. First, if the wax is allowed to accumulate manipulation of frames becomes difficult and hive management becomes more time consuming. The risk of squashing the queen when removing frames is also greater. Secondly, there is a significant financial benefit in removing this wax and selling it.

Whenever working hives, carry a tin to collect wax scrapings. This should have a lid, as at certain times of the year honey which becomes incorporated with the scrapings will encourage robbing. An old cake tin is suitable, and is made even better if fitted with lugs on one side so that it can be hung on the end of an open hive.

Use an ordinary hive tool to scrape hive parts. The tops of the top bars can be scraped as frequently as necessary, and this operation only takes a few moments. The bees should first be smoked off the top bars. Gloves are useful for this job.

Take extra time at least twice-yearly to clean the sides of the top bars, end and bottom bars, as well as other parts of the hive. Be careful when cleaning queen excluders not to distort the wires in any way. They are best cleaned by leaving them in a solar wax melter for several hours.

Scrapings can be dealt with in the same way as cappings

— by solar wax melter, hot water, or oven.

Studies show that 500 g of scrapings wax can be removed from a hive each year. These small pieces of wax, although individually not very important, represent a significant amount of money over many hives over a period of time.

**Culled Combs**

The third source of beeswax is from old or damaged combs that are culled from the hives and rendered down to recover their wax content. There is little reason for culling combs in the first few years of a hive's existence. However, as combs become older they may need replacing for a variety of reasons.

The comb may be broken, perhaps through faulty embedding in the first place. Bees will often repair broken comb by creating drone cells rather than the smaller worker cells. Large areas of drone cells may be cause for replacing combs. Brood combs that are clogged with old pollen leave no room for the queen to lay eggs. Old brood combs can act as a reservoir of ***Nosema apis*** spores, and regular comb replacement may be an important part of control in areas where this disease is significant.

A regular comb replacement programme is an important part of hive management. As a guide, about three combs per hive per year are usually replaced.

Dealing with old combs can be a problem for smaller domestic beekeepers, as large and expensive equipment is really necessary to do the job effectively. Consequently many hobbyists do not replace combs as they should, and any that are replaced may simply be thrown away.

A well-constructed solar melter recovers about 33% of the wax from old brood combs that are heaped on the tray. If the combs are stacked neatly in a single layer on the tray the recovery rate rises to about 50%. The remaining wax is left behind in the "slumgum", which also consists of old pupal cocoons, pollen, and general debris. It is probably uneconomic for a beekeeper with only a few hives to recover this wax, and slumgum from a solar melter is best used as a garden mulch or added to a compost heap, where it provides valuable nutrients.

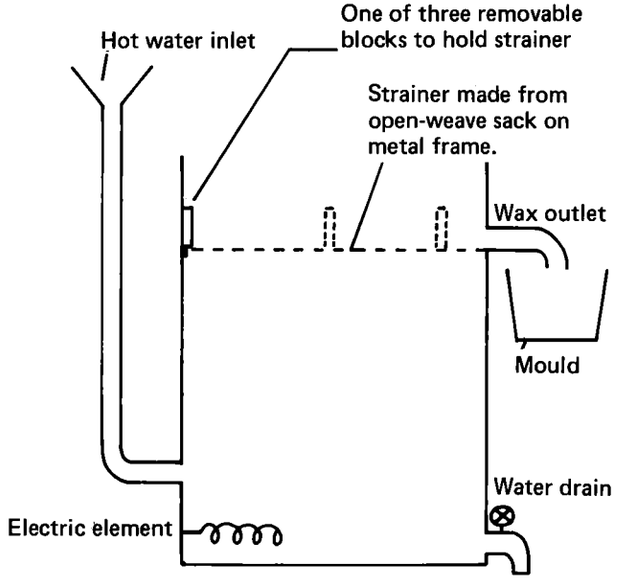


Fig. 3: Simple boiler for rendering old combs.

Fig. 3 shows a small boiler which is useful for dealing with culled combs (and wax from other sources). It can be made relatively cheaply, and could be shared by several beekeepers or members of a club.

Old combs are melted in hot water in the vessel, which is heated electrically, and a mesh screen is placed over the surface of the wax/water mixture. Tipping a quantity of hot water in the funnel will force the wax up through the screen (which filters out any impurities) and out into a mould.

For a commercial beekeeper who collects a significant number of old combs but can't afford wax processing equipment, beeswax processors will undertake rendering for a fee.

**Sale of Wax**

Wax of different colours should be processed separately, as monetary return from it is based upon colour and purity.

There are two ways to dispose of beeswax. First, it can be sold to bee equipment firms or to manufacturers who use beeswax. Secondly, it can be sent to comb foundation makers, who will convert it into the equivalent weight of foundation and charge only a conversion fee and freight. As the conversion fee is relatively small compared with the high price of foundation, this is much better than selling wax and later buying foundation with the money obtained.

**Comb Foundation**

There are two common grades of foundation — thin super and medium brood. The former should only be used for section or cut comb production. Medium brood grade is usually used for all other purposes, including extracting combs.

Foundation may be purchased in lots of 10 sheets or, at a significant saving, in cartons (about 220 sheets of medium brood). It should be stored until needed in a cool place away from light and away from all forms of insecticide, especially "pest strips" and fly spray. These are readily absorbed by the wax and may kill bees when the foundation is used.

Before embedding foundation in the frame wires, remove it from storage and place it at room temperature (20–25°C) for about 24 hours. Cold foundation is quite brittle and will break if not handled carefully.

Occasionally wax foundation that has been in storage develops a "bloom" on the surface which appears as a white growth. This is simply a physical property of the wax and is in no way harmful to bees. Wax foundation can be stored for many years and is not usually attacked by wax moths.

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