This resource is intended for use by beekeeper trainers in tropical Africa.

**Using this training resource**
The material presented in this module can be used as part of a training course. It is always useful to assess the needs of the training participants before delivering the training, to make sure that the topics covered meet the needs of the trainees. We encourage you to combine theory training with practical sessions. Practical training requires more preparation – for example you need to identify a suitable venue and assemble the necessary equipment: This is the most effective way for people to learn. Ideas for group energisers, example test questions and tips for trainers are also provided.

Words appearing in **bold** are defined in the glossary on page 19.

**At the end of this module participants will:**
- Appreciate the value and different uses of beeswax
- Have an understanding of issues regarding beeswax quality
- Know how to render beeswax using hot water
- Know how to render beeswax using a solar wax extractor
- Have an understanding of the different markets for beeswax

**Modules in this series**
Value and life of the honey bee
Choosing and making a bee hive
Honey bee colony management
Harvesting and processing honey
*Processing beeswax*

**Other resources**
A variety of other resources are available from [www.beesfordevelopment.org](http://www.beesfordevelopment.org)
Beekeepers in developing countries can apply online for a sponsored subscription to *Bees for Development Journal*.

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This booklet was purchased by TUNADO as part of the Beeswax Skills Training Project funded by PFSU in 2019.

**ISBN 978 1 898807 38 4**

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**BEEWAX - VALUE, USES AND QUALITY**

Bee wax is the substance used by bees to build combs: these combs form their nest, where they raise their young and store their food supplies (honey and pollen). Bee wax is made by young worker bees which secrete it as a liquid from eight wax glands on the underside of their abdomen. On contact with air the wax hardens and forms into a tiny scale. Worker bees can produce eight scales of wax every 12 hours. The bees chew the wax scales before passing them to other bees who form them into the hexagonal shaped cells that make up comb. One million wax scales are needed to make one kilogram of bees wax. Newly produced wax is white and gradually becomes yellow as it takes up colour from pollen and honey. If it is used for storing honey it will retain its light colour, however the longer brood combs are in use, the darker they become.

Bee wax is valuable, yet this value is not always fully appreciated or understood. Bee wax is harder and has a higher melting point (64°C) than some other waxes, it is insoluble in water and resistant to oxidation, making it desirable for use in certain products. Bee wax has more than 300 industrial uses and is used in the manufacture of cosmetics, medicinal drugs, polishes, soaps and candles. Bee wax has many traditional uses in Africa, for instance artisans use bee wax in the lost-wax method of casting small metal objects, and in creating batik fabrics. Bee wax is also used in top-bar hive beekeeping to attract bees to the hive and to create starter strips on the top-bars for bees to begin constructing combs.

Countries in Africa produce significant quantities of bee wax because fixed comb hives are the norm. The harvesting of honey from these hives involves the harvesting of bees wax too because the removed combs cannot be replaced (unlike in frame hives). The ratio of honey to bees wax production is about 10:1. In contrast to honey, bees wax is not a food product so international trade regulations are not as stringent, making trade and export more feasible.

Bee wax is a valuable export crop for Africa.

Bees wax is valued according to its purity and colour. Light-coloured wax is more highly valued than dark-coloured wax. This is because dark colourations may be an indication of overheating or contamination. The main quality issues concern authenticity of origin and contamination by chemical residues. Toxic chemicals, such as those used to control honey bee diseases, can accumulate in bees wax, so the use of any chemicals must be avoided. Due to the value of bees wax, people try to falsify or dilute it with cheaper materials. Adulteration with paraffin wax depresses the melting point and weakens the material. Pure bees wax has a good smell and when broken has a grainy surface. That is not the case if it has been adulterated with paraffin, fat or other oil. *(Relevant activity: “Testing for purity” on page 18)*

**GOOD QUALITY BEEWAX IS**

- **Pure**
  - Never mix with paraffin or contaminate with other substances

- **Stored Properly**
  - Keep in a cool, dry environment away from strong smelling substances

- **Processed Carefully**
  - Do not burn, boil or over-heat

- **Filtered**
  - Remove impurities (e.g. cocoons, excess pollen)

**REMEMBER**

Pieces of comb are often discarded during honey harvesting and processing. However, beeswax is valuable. Develop a beeswax collection scheme among local beekeepers: by selling collectively you can create income from a resource that may otherwise be wasted!
Remember to separate dark combs from light combs to keep the final quality high.

**Wax cappings**, old **honeycomb**, old brood combs and odd bits of comb built by the bees as part of the nest structure can all **yield** valuable beeswax.

However, if combs are stored in the open they will be eaten by **wax moths** within a few weeks. Old combs may harbour honey bee diseases. Melting beeswax and forming it into a solid block enables it to be stored for long periods. Most beekeepers achieve excellent results using homemade equipment to **render** beeswax.

**REMEMBER**

Clean beeswax blocks are not attractive to wax moths.

© Photograph by Mark Rutaro

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**THE HOT WATER METHOD**

**PREPARATION**

Only use equipment made from enamel, clay, stainless steel, plastic, wood or even calabashes.

Brass, copper, zinc, pewter, tinplate or iron should never be used because they will react with and stain the beeswax.

**STEP ONE**

**WASH**

Remove as much honey as possible from the combs and wash them by soaking them in clean rain water (honey remaining in the combs will be rinsed out in the water).

Repeat this washing process three times. After washing the combs, break them up into small pieces.

**STEP TWO**

**MELT AND SQUEEZE**

Place the combs in a pan and add clean water to the level of the combs or a little above. Beeswax should never be heated without water because it is highly flammable and will burn. Stir the mixture, and heat it gently.

After the combs have melted, pour the molten beeswax and water mixture into a cloth bag. Using two wooden poles, squeeze the mixture out of the bag into a receiving container. Brood, pieces of wood, grass and any other large particles will be retained in the bag.
STEP THREE
COOL AND SCRAPE

Leave the bucket with the mixture of hot water and molten beeswax in a shaded room to cool. The wax solidifies as it cools, forming a disc of beeswax on the surface of the water.

Any particles that were not filtered by the bag will settle below the layer. When the mixture is completely cool, remove the beeswax disc. Scrape off any material stuck to the underside of the beeswax disc. The beeswax is now ready to be sold.

STEP FOUR
REFINE AND USE

If you wish to use the wax yourself, you can refine it further. Remelt the beeswax disc in a pot. Place this pot in a larger pot of water and heat the water over a fire. Once the beeswax has melted, pour it through a finer cloth into a receiving container that has been smeared with a very dilute film of detergent in water. This will help remove the beeswax from the container when it has hardened. After pouring the mixture into the bowl, wait for it to cool completely.

Remember, beeswax purified carefully using these methods should be in a suitable state for sale or even export and does not require any further processing.

WARNING

Beeswax easily absorbs residues and scents. Only the highest quality beeswax can be used in the cosmetic and food industries. Beekeepers may accidentally introduce contamination during the rendering process.

To avoid contamination, all containers for heating, cooling and storage of beeswax must not have been used to hold chemicals. Straining materials such as mosquito nets are often impregnated with insecticides which will contaminate the molten wax. Clean cotton t-shirts from the market can serve as a suitable alternative.

Keep rendered beeswax in clean, sealed containers or sacks until it is sold, to avoid any risk of further contamination.

SACK AND BARREL METHOD

Another method is to put the broken combs into a hessian sack with some clean stones in it. Drop the sack into a large cooking pot or barrel full of clean water and the weight of the stones will ensure that it sinks. Heat the water. As the beeswax melts it will filter through the sack and rise to the surface of the water.

Once all the beeswax has melted, remove the heat and leave the pot to cool down. Remove the disc of solid beeswax that will form on the surface.
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**USING A SOLAR WAX EXTRACTOR**

**Solar wax extractors** use the sun's heat to melt beeswax. They are relatively easy to make and provide a simple and effective means of melting and purifying wax. The solar wax extractor consists of a glass or clear plastic-lidded box containing a sloped sheet of metal. Pieces of honeycomb are placed on the metal sheet and as they melt, wax runs down the metal slope to a container. The sheet of metal can be bent at the edges to funnel wax towards the container. A screen of wire mesh prevents pieces of comb and debris from slipping down into the container. Impurities in the wax tend to remain on the metal, and others can be scraped off the final solidified block of wax.

The temperature inside the extractor needs to rise above 60°C to melt the beeswax. The bigger the container, the higher the temperature. To retain heat inside the box, the cover should be made of either thick plastic or two sheets of strong glass with a small gap between them. The inside of the box should be painted black for maximum heat absorption. Insulating material underneath the metal sheet will also help to retain heat. There must be no gaps in the box that allow heat to escape, or bees to enter. The collecting container must be easy to remove to allow removal of the beeswax and for cleaning. Clean beeswax melted in an extractor forms into a top quality beeswax block.

**REMEMBER**

Reposition the extractor throughout the day to ensure it is always facing the sun and tilted at right angles to the sun's rays.

Use a nail positioned on the edge of the extractor. The position of the shadow will help indicate the direction of the sun.

**GENERAL RULES FOR PROCESSING BEESWAX**

1. **BEESWAX MUST ALWAYS BE HEATED IN WATER**
   It is highly flammable and will burn if heated directly.

2. **HEATING DISCOLOURS BEESWAX**
   Boiling will ruin it. Always heat gently, and just enough to melt it: beeswax melts at 60 - 64°C.

3. **USE CLEAN RAINWATER**
   Ground water often contains lime which will react with the beeswax.

4. **COMBS OF THE SAME TYPE SHOULD BE PREPARED TOGETHER**
   Do not mix dark combs with light combs as this will lower the final quality (dark combs contain propolis and cocoons).

5. **CONTAINERS AND UTENSILS**
   These should not be made from brass, copper, zinc, pewter, tinplate or iron. Beeswax is slightly acidic and will react with and be stained by these metals.

6. **BEESWAX MUST NOT BE ALLOWED TO COOL TOO QUICKLY**
   Impurities and water will be trapped inside the wax as the block sets and it will have to be rendered again. To avoid this, simply place a few sheets of cardboard over the top of the container to slow down the cooling process.

7. **SLUM GUM IS THE BLACK RESIDUE THAT REMAINS AFTER RENDERING**
   It contains cocoons from brood cells and larvae excrement. It burns well and, if soaked up in old newspaper, can be used as fuel for cooking, or to make firelighters.
STORING AND SELLING BEESWAX

Around half of the world’s production of beeswax comes to market, the rest is either used by the beekeeper or thrown away. Yet beeswax is proportionally more valuable than honey. Beeswax is an excellent export crop for rural communities for several reasons:

- **Processing** is easy: rendering beeswax to a quality suitable for export involves only heating and filtering to ensure it is clean.
- **Storage** is simple: care needs to be taken to ensure that it is stored away from bright light, heat and toxic chemicals.
- **Transportation** is easy: no special packaging is required. It can be transported as lumps of unwrapped beeswax inside hessian sacks.
- **Beeswax** does not deteriorate with age.
- **Regulations** are less stringent than for honey.

Beeswax is used in the industrial manufacture of **pharmaceuticals**, cosmetics, and wax **foundation** for frame hive beekeeping. These industries require first class beeswax that has been heated as little as possible. The European Union imports around 6,000 tonnes of beeswax per year, approximately 50% from developing countries. The main importing countries are France, Germany and the UK. Ethiopia is the world’s fourth largest supplier of beeswax. International beeswax buyers require large quantities of wax for export and are not interested in buying small amounts from individual producers. Buyers usually look to buy 1 - 10 tonnes.

If you want to export your beeswax, the best approach is to sell beeswax to your local beekeepers’ association or cooperative so they can bulk up and consolidate into a large volume. To make it possible for your association to export they will need to buy and store a large volume of wax and this can create **cash flow** difficulties. Beekeepers can help reduce the time it takes for an association to accumulate a large volume by ensuring they render and sell every piece of comb that is available to them. This will help the association to secure an onward sale as quickly as possible.

Beeswax does not need to be sold to international markets to obtain a good price. Beeswax has many local uses and supplying to domestic markets may be equally profitable and more feasible for the individual beekeeper.

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**BEESWAX CAN BE USED IN**

- Cosmetics
- Candle making
- Lost-wax casting of metals
- Polishes for wood and leather
- Baiting bee hives, e.g. starter strips
- Wax printing and batik dyeing of cloth
- Treatment of cracked hooves for livestock
- Strengthening and waterproofing of thread for sewing

and many more products.
IDEAS FOR ENERGISERS

Energisers are designed to motivate participants and reinforce the key messages. Activities should be relevant to the learning objectives of this module. Instructions must be clear to avoid confusion. Time for group reflection will ensure the intended message has been conveyed.

Case studies - Divide the class into small groups. Describe a different scenario to each group, the groups must then decide on the best marketing strategy given the scenario. Describe scenarios that reflect recognisable, local situations, e.g. a village producing bronze art, one with poor road access, another near the junction of two major roads.

Demonstration - Volunteers are given the task of demonstrating a technique they have just learned and describing the process to the rest of the class. Other members of the group can help the volunteers by making suggestions if they have forgotten a stage in the process.

QUESTIONS FOR ASSESSMENT

At the end of the module it is good practice to assess whether participants have learned what they need to know. This helps them and it helps you too. They will be confident that they have learned something, and you will know whether you have achieved the learning objectives. If participants are unable to answer questions, clarification will be required.

EXAMPLE QUESTIONS

1. How do honey bees produce beeswax?
2. What do the bees use beeswax for?
3. What is special about beeswax?
4. What can affect beeswax quality?
5. Why should combs not be stored for long periods?
6. Describe two methods of rendering beeswax.
7. Why should the dark and light combs be rendered separately?
8. What effect does heating above 70°C have on beeswax?
9. What materials should never be used with beeswax?
10. Name four products that contain beeswax.

TRAINING TIPS

1. Preparation is vital. Do some background reading in addition to reading this booklet. Participants often ask questions you do not expect. More detailed information is available from www.beesfordevelopment.org.
2. Organise practicals well in advance and ensure that you have all the equipment and training resources needed. Plan your procedures in case of an accident or medical emergency.
3. Learning is enhanced when training is participatory. Ask lots of questions and give participants the opportunity to discuss the subject. Involve participants in practical sessions.
4. Make lessons interesting. Seeing as well as hearing helps participants to understand and remember. Explain things by using examples people can relate to. Share experiences. Humour helps!
5. Adapt resources and teaching style to the training situation. The lesson plan on pages 10 and 11 is suggested only as a guide. Adapt the course content according to the previous experience of the participants. Find out the level of literacy and the preferred language of the group, and adjust your teaching methods to suit.
6. Photocopy sections of this booklet and give them as handouts.
7. Reflect on your teaching. What worked and what did not? You could consider asking similar questions to the participants, possibly in the form of an anonymous training evaluation questionnaire.

FURTHER READING

Facts about Wax - Part 1: Beeswax in apiculture
Bees for Development Edition 126

Facts about Wax Part 2: Comb and foundation
Bees for Development Edition 127

Facts about Wax - Part 3: Quality of beeswax
Bees for Development Edition 128

Facts about Wax - Part 4: Quality of beeswax
Bees for Development Edition 129

All of the above can be found at http://www.beesfordevelopment.org/journal/


ACTIVITIES

1 TESTING FOR PURITY
Roll a small piece of beeswax between your fingers. It should soften but not become sticky. Sticky wax may indicate contamination with paraffin or oil.
Break up the wax block. If the broken surfaces are grainy, it is pure beeswax. Otherwise, it may have been adulterated.

2 MAKING SKIN OINTMENT

INGREDIENTS
150g beeswax, 1/2 litre unused cooking oil and 1ml aloe vera gel.

EQUIPMENT
2 cooking pots, a fire or other heat source and a supply of small containers with lids.

METHOD
Fill one cooking pot with water and place on the fire. Melt the beeswax in the other cooking pot by standing that in the bath of hot water.
Add the oil to the beeswax and stir. Once the beeswax and oil have mixed, add the aloe vera gel and stir.
Pour the mixture into the small containers immediately after mixing in the aloe vera. Do not touch until they are fully set. Put the lids on the containers and label neatly. The ointment is now ready for sale.

GLOSSARY

Beeswax
Wax produced by honey bees. It is secreted by glands on the underside of the abdomen and used to build comb.

Brood
Bee eggs, larvae and pupae.

Cash flow
The total amount of money being transferred into and out of a business.

Cell
The single, hexagonal wax compartment that is the unit of comb. Each honey bee develops within a single cell, and honey and pollen are stored within cells.

Comb
The precise wax structure made of hexagonal cells in which honey bees rear young and store honey and pollen.

Contamination
The process by which something becomes unfit for human consumption through the presence of residues of chemicals, medicines, bacteria, organisms, dirt or waste.

Fixed comb hive
Hive in which the bees build combs attached to the ceiling and walls of a container. Once removed, combs cannot be replaced.

Foundation
A thin sheet of beeswax embossed with the hexagonal pattern of comb. A sheet of foundation is placed in wooden frames, and this serves as a base upon which honey bees build their comb. Foundation is used in frame hive beekeeping.

Frame hive
A hive containing wooden rectangular frames, each holding a sheet of wax foundation. Frames containing full honey comb are removed from the hive during harvesting. After the honey has been extracted, the frames containing empty comb can be reinserted into the hive.

Honey
Nectar or plant sap ingested by bees, concentrated by them and stored in combs. Honey is the bee’s food.

Honey bee
Bee species belonging to the genus Apis. They are social bees which store significant quantities of honey and live in permanent colonies.

Honeycomb
The wax structure made of hexagonal cells in which honey bees store honey.

Pharmaceuticals
Manufactured medical drugs.

Pollen
Pollen grains contain the male sperm cells of plants.

Render
The process of melting and cleaning beeswax and forming into blocks.

Slum gum
Residue left after beeswax has been rendered from old combs.

Solar wax extractor
A glass-covered, insulated box in which beeswax can be melted using the heat of the sun.

Starter strip
A narrow piece of a flat sheet of beeswax cut to the length of a top bar. The beeswax is attached to a top bar as a starter guide for bees, showing them where to begin building comb.

Top-bar
A piece of wood from the underside of which honey bees suspend their comb in top-bar hives.

Top-bar hive
A hive containing top-bars which enable combs to be lifted from the hive for inspection or to harvest honey. The bees build a series of parallel combs suspended from a series of parallel top-bars.

Wax cappings
Wax covering made by bees to seal cells containing ripe honey.

Wax moths
Species of moths whose larvae eat the comb, pollen and pupae of honey bees.

Worker
The female honey bee that constitutes the majority of the colony’s population. Worker bees do most of the activities for the colony.

Yield
The amount harvested.
Bees for Development
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• Championing bees and pollinators
• Alleviating poverty
• Teaching life skills
• Sharing knowledge
• Facilitating fair market access

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ISBN 978 1 898807 38 4