10. PRODUCTION AND TRADE OF BEESWAX

Beeswax is a valuable product that can provide a worthwhile income in addition to honey. One kilogram of beeswax is worth more than one kilogram of honey. Unlike honey, beeswax is not a food product and is simpler to deal with - it does not require careful packaging which this simplifies storage and transport. Beeswax as an income generating resource is neglected in some areas of the tropics. Some countries of Africa where fixed comb beekeeping is still the norm, for example, Ethiopia and Angola, have significant export of beeswax, while in others the trade is neglected and beeswax is thrown away. Worldwide, many honey hunters and beekeepers do not know that beeswax can be sold or used for locally made, high-value products. Knowledge about the value of beeswax and how to process it is often lacking. It is impossible to give statistics, but maybe only half of the world's production of beeswax comes on to the market, with the rest being thrown away and lost.

WHAT BEESWAX IS

Beeswax is the creamy coloured substance used by bees to build the comb that forms the structure of their nest. Very pure beeswax is white, but the presence of pollen and other substances cause it to become yellow.

Beeswax is produced by all species of honeybees. Wax produced by the Asian species of honeybees is known as *Ghedda wax*. It differs in chemical and physical properties from the wax of *Apis mellifera*, and is less acidic. The waxes produced by bumblebees are very different from wax produced by honeybees. Pure waxes from different species of stingless bees are also very different from the other types of beeswax. It is much darker in colour – dark brown, and when it is warmed, it stretches without breaking. It is also sticky and much more difficult to break than beeswax from *Apis mellifera*.

BEESWAX PRODUCTION

Beeswax is made by young worker honeybees. It is secreted as a liquid from four pairs of wax glands on the ventral surface of the abdominal tergites (plates on the underside of a bee's body). The liquid wax spreads over the surface of these plates, and, on contact with air, the wax hardens and forms a single wax scale on each tergite, which can be seen as small flake of wax on the underside of the bee. A worker honeybee produces eight scales of wax every 12 hours. The size of the wax glands depends upon the age of the worker: they are at their largest when the bee is about 12 days old and decline steadily after the eighteenth day until the end of her life.

About one million of these wax scales are needed to make one kilogram of wax. Bees use the stiff hairs on their hind legs to remove the scales of wax and pass them on to the middle legs, and then to the mandibles (jaws) where wax is chewed, and salivary secretions become mixed with the wax. When it is the right consistency, the new wax is used for comb construction or used to seal honey cells**.** Bees are stimulated to produce wax when there is a surplus of honey to be stored and a lack of honeycomb in which to store it. Around eight kilograms of honey are consumed by bees to produce every one kilogram of wax.

When a swarm of bees settles to establish a new nest, the first thing they do is to start building beeswax combs. To be able to produce the beeswax and build with it, the bees need a high temperature, and the production of the first comb takes place inside the congregation of bees, where the temperature is highest. The bees building a comb join together and make what are known as 'garlands' or 'festoons' – chains of bees. Hanging like this they secrete the wax. When the beeswax is ready on a bee, she moves up the chain to the place where the building is going on, fetches one of the wax scales with her hind legs and brings it to her mouth where it is chewed and mixed with secretions before it is used for building. This is repeated until all eight wax scales are used. During the comb construction, the building bees vibrate the comb by knocking it with their upper jaws. In this way, they seem to be able to judge the thickness of the comb and this guides them to know if some wax has to be gnawed off or if more has to be added.

COMB

The comb provides the structure of the bees' home, used for all the different storage functions needed in a bees' nest: to store honey, to store pollen, as a place to deposit eggs and for development of the young bees. The comb has a hexagonal cross-section. This shape is created by the worker using her antennae to maintain the shape of each cell during its construction. The shape and dimensions of the cells in comb optimise the ratio of size to strength of the materials used in its construction. The six-sided cells and the pyramidal-shaped bottom of the cell also represent a highly efficient use of material with no wax being wasted. There are no empty spaces between the cells while at the same time the highest possible strength from the wax is achieved. The top row of cells that connects the comb with the ceiling of the nesting place (tree wall, hive, frame or the top-bar) can carry more than 1,300 times its own weight in honey plus all the bees working and living on the comb. Only if the inside temperature exceeds +35 °C, the wax will begin to soften and melt, and the combs loose their strength and may collapse. Understanding the properties of beeswax comb brings understanding of the great effort that bees have to make to maintain nest temperature. If a hive is situated without shade, bees will have to expend more effort in working to keep the hive contents cool.

BEE SPACE

In honeybee species whose colonies have multiple combs, the combs are a precise distance apart in order to enable honeybees to work in the combs, to move between them, and maintain temperature. If humans keep bees in hive boxes, then it is necessary to create an environment in the hive that imitates the way the bees build their nest in the wild. Therefore, frames in frame hives must be spaced at the same distance as the combs would be spaced in a natural nest. The distance between the centre of a comb to the centre of the next comb also varies between different races of bees: for example, the space is around two millimetres smaller in the combs of African *Apis mellifera* bees compared to the European races of *Apis mellifera*. The distance permits two worker bees to pass each other when they crawl in the space between the brood combs. In the honey storing areas of the combs, the cells are often built deeper so that only one layer of bees can pass between.

If space allows in a hollow tree or in a wall, the combs of *Apis mellifera* can be more than one metre long, and carrying several kilograms of honey in each comb. Normally a comb is built from the top to the bottom, starting with a small elliptical-shaped comb. A comb consists of a central laminate with the six-sided cells on each side. Each cell is angled slightly upwards, with the opening a little higher than the base. In naturally constructed combs, the dimension of cells also varies according to the species and race of honeybees. The typical dimensions for worker cells built by races of European *Apis mellifera* bees are between 5.13 mm (*Apis mellifera ligustica*) and 5.5 mm (*Apis mellifera carnica*). European races of *Apis mellifera* accept wax comb with 800 cells/dm^2, which allows for cells with a diameter of 5.4 mm. *Apis cerana*, the Asian hive bee, needs a smaller cell size. Cells built for drone brood are larger than are those built for worker brood.

BEEKEEPING FOR BEESWAX PRODUCTION

An important aspect of frame hive beekeeping is the recycling of empty combs (inside frames) to the hive after the extraction of honey, thus maximising honey production and minimising the production of wax. Therefore, beekeeping that uses movable-frame hives (for example, Langstroth hives and Newton hives) results in the harvesting of relatively little beeswax. Using these sorts of hives, the ratio of honey to beeswax production is approximately 75:1.

Beekeeping using local style, fixed-comb hives, or movable-comb (top-bar) hives results in greater yields of beeswax since the delicate honeycomb is broken to enable the extraction of honey, and cannot be returned to the hive. The ratio of honey and beeswax production using fixed comb or movable-comb hives is about 10:1. For this reason, countries in Africa where fixed-comb beekeeping and honey hunting may be the norm, produce significant amounts of beeswax, which provide a valuable export crop for some of these countries. In some situations, wax rather than honey can be the most valued product of beekeeping.

When there is good honey-flow i.e. plenty of nectar coming into the hive, bees are stimulated to make wax to build comb to hold the nectar. During dearth periods beeswax production stops: when necessary bees recycle wax from existing comb to seal their honey and brood cells.

The wax-producing bees need plenty of food: as mentioned above, bees consume around eight kilograms of honey to produce one kilogram of beeswax. When the bees swarm from an old colony and have to build new combs, the wax production and building is undertaken by all ages of worker bees. The young bees have to start wax production sooner than they would in an established colony, and the older bees have to resume beeswax production.

BEESWAX QUALITY

Newly produced wax is clear white, but after manipulation by the bees, it soon turns pale yellow. New honeycomb is nearly white and if it is only used for honey storing it will retain its light colour. When the comb is used for brood it turns darker the longer it is in use. This is due to the larvae's cocoons spun inside the cell before pupation. Some excrement from the larvae is also sealed in the cells.

The colouration of beeswax (shades of yellow, orange and red through to brown) is due to the presence of various substances, especially pollen. This difference in colour is of no significance as far as the quality of the wax is concerned, but subjectively light coloured wax is more highly valued than dark coloured wax. If wax is dark because it has been over-heated then its value is much lower. The finest beeswax is considered to be from wax cappings. *i.e.* the wax seal with which bees cover ripe honeycombs, because this fresh 'virgin wax' is pure and white coloured. In the past, it was common to bleach wax (using bleaches such as sulphuric acid or hydrogen peroxide), but this practice is now considered unnecessary and damaging to the natural wax.

The main quality issues concern authenticity of origin, and contamination from residues of drugs used to control honeybee diseases, mainly the acaricides used to control mite predators. These acaricides are lipophyllic and therefore are soluble in beeswax, and accumulate in it. Other chemicals sometimes used in beekeeping may also accumulate in beeswax; these may include paradichlorbenzene, used to control wax moth, and various wood preservatives used to paint beehives. This contamination of beeswax can be minimised by avoiding the use of synthetic chemicals in beekeeping. The use of these chemicals in beekeeping in industrialized countries makes beeswax harvested from the disease-free colonies of Africa and other developing regions more attractive.

Pure beeswax has a good aroma, and when a wax block is broken, it shows a grainy surface. That is not the case if it has been adulterated with paraffin, fat or other oil. If pure beeswax is chewed, it does not stick to the teeth, and when rolled between fingers it softens but does not stick to the fingers. When paraffin wax is mixed with beeswax, it becomes more transparent and slightly greasy to the touch.

BEESWAX COMPOSITION AND PROPERTIES

Beeswax is a very stable substance, and its properties change little over time. It is resistant to hydrolysis and natural oxidization and is insoluble in water. It is a complex material consisting of many different substances, but predominantly of esters of higher fatty acids and alcohols, pigments mostly from pollen and propolis, as well as minute traces of bee material.

It is solid at room temperature, becomes brittle once the temperature drops below 18 °C and quickly becomes soft and pliable at around 35 to 40 °C, with a melting point of 64.5 °C.

USES OF BEESWAX

Beeswax has hundreds of uses, of which the following are but a few examples.

In cosmetics

Around 40 percent of the world trade in beeswax is used for the cosmetics industry, which requires first class beeswax that has not been overheated, is pure and free from propolis. The world price is

usually around US$4-10 per kilogram. At a local level, making skin ointment from beeswax can be one of the most profitable beekeeping activities.

In pharmaceutical preparations

Around 30 percent of world trade in beeswax is used by the pharmaceutical industry that, like the cosmetic industry, requires good quality wax.

Candle making

Around 20 percent of the beeswax trade is used for candle making. Beeswax candles are less common and more expensive than candles made from paraffin wax. In the past church candles had to be made of 100 percent beeswax, and this is still followed in some societies.

Other uses

Around 20 percent of the world trade in beeswax is used for:

- Models and casting in industry and art. Wax is used for to make figures for decoration or sculptures and jewellery before they are placed in a mould for casting in silver, gold or bronze. This method is called lost-wax casting or *cire perdu*.
- To make polish for cars, furniture, shoes and for treatment of other leather products.
- In grafting waxes.
- In lubricants for industrial use.
- Electronics used as insulation in electronic components in the computer industry, and in the manufacture of CDs.
- In poor societies, beeswax is used as a sealant, for example to make air and water-proof sealing of bottles and containers, to repair of broken calabashes, for grafting on branches, etc.
- In batik dying of fabrics.
- In making drawing crayons.
- It is used for confectionery coatings.
- It is used to strengthen threads used in darning and sewing.

In beekeeping

- Beekeepers use large quantities of beeswax for making beeswax comb foundation. Beekeepers harvest, process and recycle their own beeswax and this use is not evident in the trade statistics. In many countries where frame hives are used, it may be the major use of beeswax. It is a common practice for beekeepers to render the beeswax from their own bees into lumps of pure beeswax, and to exchange this for a smaller weight of ready-made sheets of foundation, made by commercial foundation manufacturers.
- Beeswax is used to attract swarms to empty hives, or trap hives, and is one of the most effective attractants for bees.

INTERNATIONAL TRADE

It is not easy to obtain official statistics concerning beeswax production: for example, there are no official figures for beeswax production in EU countries. The EU imports around 6,000 tonnes of beeswax per annum, approximately 50 percent of this coming from developing countries. The main importing countries are Germany, France and the UK. These nations all have significant pharmaceutical and medical industries requiring beeswax.

Tropical countries dominate world beeswax production and export, with industrialized countries needing to import beeswax. This is because, as described above, in local styles of beekeeping both honey and wax are harvested.

TABLE 20
World production and trade in beeswax

World trade in beeswax (tonnes)	Year	Annual production (tonnes)	Export (tonnes)	Import (tonnes)
World	2003		10 336	11 949
Asia	2003		5 213	1 995
Africa	2003		795	258
Europe	2003		2 167	6 873
Angola	2003		0	8
Argentina	2003		0	0
Australia	2003		0	0
Chile	2003		1	22
China	2003		4 814	127
Dominican Republic	2003		39	1
Ethiopia	2003		402	1
France	2003		495	1 243
Germany	2003		919	2 363
Japan	2003		89	713
Kenya	2003		0	1
Mexico	2003		14	71
Portugal	2003		10	32
South Korea[14]	2002	151		
Spain	2003		113	336
Tanzania	2003		0	0
Thailand[15]	2002	50	43	
Trinidad & Tobago[16]	2001	1.1	-	7
Uganda	2003		0	0
United Kingdom	2003		102	731
USA	2003		1 097	2 195
Zambia	2003		33	0

Source: All data FAOSTAT, 2005, unless stated otherwise.

DO NOT WASTE BEESWAX

In areas where most or all of the honey produced is consumed locally, and where there is no local use for beeswax, pieces of wax comb are often discarded. The development of a wax collecting system can, by encouraging each beekeeper in the area to save beeswax and by organising the sale of the combined crop, provide a source of income from an otherwise wasted resource. Both honey hunters and beekeepers should realise that beeswax is a valuable product in addition to honey. If old combs are stored without treatment, especially in the tropics, they will be eaten by wax moths within a few weeks. Old combs can harbour honeybee diseases and if left lying around can cause honeybee disease to be spread from one colony to another. Mice can chew the wax combs and make a lot of damage in a hive, but most animals cannot digest the wax, it just passes thought the gut. Only the various species of wax moth larvae can digest wax, and maybe some birds that have the necessary bacteria in their guts to break down the wax, as ruminants do with cellulose.

[14] Kun-Suk Woo, 2004.
[15] Sureerat Deowanish, 2004.
[16] Ministry of Food production and Marine Resources Report on Apiculture 2002.

ADULTERATION OF BEESWAX

Beeswax is relatively expensive, and there has always been a tendency for people to try to falsify or dilute it with cheaper materials. The melting point of pure beeswax is 64.5 °C, and adulteration of pure beeswax with paraffin wax reduces the melting point and weakens the material. This is important since one kilogram of wax in honeycomb supports 22 kilograms of honey, pollen and brood. It follows that using adulterated wax for the foundation used in frame hive beekeeping will cause unnecessary problems for the bees and the beekeeper.

BEESWAX RENDERING

Cappings (the white covering on sealed honey comb) are the best source of beeswax, but odd scraps of brace or burr comb (odd bits of comb built by the bees as part of the nest structure), old honey combs and old brood combs all yield valuable beeswax harvest. The beekeeper with a just few hives can produce blocks of wax of excellent quality from these sources.

Whatever beeswax is to be used for, it has to be melted and cleaned. As soon as it has been melted and turned to a solid wax block, it can be stored or transported without any problems. The wax block is not eaten by wax moths. There is plenty of expensive equipment available to achieve beeswax rendering. This includes stainless steel solar-wax-melters, steam-wax-melters, wax presses, wax and honey separators and electric melters. However, most beekeepers do not own such equipment and achieve excellent results without spending any money on equipment, and with no risk of it being stolen.

GENERAL RULES WHEN WORKING WITH BEESWAX

- Beeswax must never be heated with a direct flame: always heat it in a container of water. This water bath might be an oil drum or other large container. It is not necessary for the wax to be in a separate container in the water bath. Heat the wax enough to melt it: beeswax melts at 62-64 °C. Heating above 85 °C causes discoloration of the wax, and boiling will ruin it. If beeswax is heated to such a temperature that it burns it is wasted completely.
- The best water to use when working with beeswax is soft, clean rainwater. Hard water contains lime that reacts with the wax and saponifies it.
- Beeswax is slightly acidic and containers made of aluminium, brass, copper, zinc, pewter, tinplate or iron must never be used with beeswax, as they will react with the beeswax and the wax will be stained. Suitable materials to use when working with beeswax are containers made from enamel, stainless steel, nickel, or plastic.
- Combs of the same type should be prepared together. Do not mix dark combs with light combs as this will lower the grade of the best wax.
- It is easy to make a filter for hot wax by completely removing each end of a clean can and stretching a piece of cotton cloth over one end. The string used to hold the cotton in place also serves as a handle.
- Whatever system is used to render and extract the beeswax, it will solidify once it cools down. Regardless of the system used, the recuperated wax will contain numerous impurities. Due to the difference in density between wax and water, the wax will rise to the surface of the water and any impurities will be trapped below it. If the beeswax cools too quickly, a large quantity of these impurities and water will be trapped inside the wax as the block sets and it will have to be rendered again. Once the wax hardens, impurities can be scraped off the underside of the block. To obtain the purest beeswax, the water-wax mixture should cool down as slowly as possible. An easy way to slow down the cooling process is to place the bucket with wax and water mixture in a heat-retaining box (filled with polystyrene pieces, or sawdust) covered with a thick lid. Once the wax has settled and completely cooled, the block is ready to take out of the mould.
- Many containers make convenient moulds for beeswax. Foil-lined drink cartons make convenient, disposable moulds of a useful size. When the wax has solidified completely, the carton can be simply torn away, leaving a lump of beeswax.

TRADITIONAL METHOD OF EXTRACTING WAX FROM COMBS

Materials needed: pieces of honeycomb, water, a pan for melting the wax, a rush bag, or any type of loosely woven bag, cloth material with a fine mesh, soap, a bowl for moulding the wax.

1. Remove as much honey as possible from the honeycombs and soften them by soaking in warm water: pollen and any honey remaining in the combs will dissolve in the water. Repeat this washing process three times.
2. Use clean rainwater if possible. If the water is very alkaline, add a little vinegar (one part vinegar to 1,000 parts water).
3. After washing the combs, break them up into small pieces.
4. Place the pieces of comb in a pan and add clean water to the level of the combs or a little above.
5. Heat the mixture gently and keep stirring all the time, especially when the mixture starts to reach high temperatures. Wax is highly flammable.
6. After the combs have melted fully, pour the mixture into a long bag made of sacking, woven rush, nylon, jute or other heavy cloth, and tie it tightly. Holding the whole thing over a basin or bucket, squeeze the bag with two pieces of wood, to make sure that all the wax is squeezed out of the bag into the bucket underneath. Brood, pieces of wood, grass and other large particles will be removed by this process.
7. Leave the bucket with the mixture of hot water and molten wax to cool, placing it in an area sheltered from high winds and dust: preferably a corner in a clean and cool room. The wax solidifies as it cools, forming a disc of wax on the surface of the water. Any particles that have escaped through the bag will settle below the wax layer.
8. When the mixture is completely cool, remove the wax layer. Scrape off any material stuck to the underside of the wax disc, and re-melt the wax in an equal volume of clean water. This time use a finer cotton cloth to strain small impurities out of the wax. After filtering through the cloth, collect the hot mixture of wax and water in a bowl, preferably enamel, which has been smeared with a film of soapy water – only a very small amount to cover the surface. The bowl should not hold more than about two kilograms of wax. Even bowls made from wood or calabashes can also be used as moulds for beeswax. Do not use fat or oil instead of soap, as these would contaminate the wax. Do not use heavily scented soap.
9. Place the mixture in a cool place free from dust and wind. When the water and wax have completely cooled down i.e. about 12 hours after pouring the mixture into the enamel bowl, a mould of beeswax can be easily shaken out. Any impurities adhering to the bottom of the cake can be scraped off with a sharp knife.
10. Do not disturb the wax until it has cooled for 12 hours. Do not try to hurry the process or you may spoil the wax.
11. Beeswax purified carefully by this method should be in a suitable state for sale and export and does not require any other processing.
12. Store refined beeswax in a clean place, away from any strong-smelling substances.

Another traditional method is to simply put the broken combs into a hessian sack and drop it into a large cooking pot full of water, with the sack weighted so that it sinks. Heat the water. Wax is lighter than water, so that as it melts, the wax will filter through the sack and rise to the surface. Once the combs have all melted, turn off the heat and leave the pot to cool down.

SOLAR WAX EXTRACTOR

The solar wax extractor provides a simple and effective way of melting and purifying beeswax. It uses the sun's heat to melt the wax, and an effective solar wax extractor can be easily 'home-made'. The temperature inside the extractor needs to rise only to 68-70 °C to melt the beeswax sufficiently: if clean wax is used, just one melting in a solar wax extractor can produce a satisfactory block of top quality 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 dimensions of the extractor can vary according to the container size used to make it. The bigger the overall container, the higher the temperature that can be attained inside the extractor.

To retain heat inside the box, the cover of the solar wax extractor is best made either of thick plastic or of two sheets of strong glass with a small gap between them. The rest of 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 draught-creating cracks or gaps in the box, as they will encourage heat loss, and if large enough would allow robber bees into the box. Do not fix the collecting tray in the bottom of the extractor: it needs to be removable for cleaning.

Ideally, the solar wax extractor is positioned regularly during the day so that it is always facing the sun, and tilted so that the glass is at right angles to the sun's rays. If this is not possible, fix supporting legs under the extractor to achieve a slope of about 40° to the horizontal, and face the extractor towards the sun. Shadows from trees and buildings or passing clouds soon lower the temperature inside the extractor.

HARVESTING WAX FROM VERY OLD, BLACK COMBS

Even very old, black scraps of comb can be of some value to obtain beeswax. However, beeswax cannot be obtained from them using a solar wax extractor. This is because such combs contain large numbers of cocoons and pupa cases discarded by successive generations of developing honeybees, and these soak up the wax as it is melted. Wax from such combs can be obtained by breaking them up, and soaking them in water for 24 hours, then tying the combs in a piece of sacking and boiling this in a container full of water. Some wax will float to the surface, but the bag of wax must be agitated to obtain the maximum harvest. If left to cool overnight, a round cake of solid beeswax will form on the surface of the water.

METAL FOIL METHOD

A very simple way to melt small scraps of comb is to place them on a piece of aluminium foil or other shiny metal foil, and leave in the sun. In strong sunlight, the wax will soon melt and can be poured into a container.

EXTRACTION WITH BOILING WATER AND A WAX PRESS

Pieces of comb are placed in a large container (around 100 litres), about one third full of boiling water and allowed to melt. When all the wax has melted pour the contents of the containers into a jute-lined wax-press. When pressure is applied, the wax runs out. After the first pressing, the content can be stirred and then pressed again, and this process repeated until all the wax is extracted. Once again, the water and molten wax run into a container, where, as the mixture cools, the wax rises to surface because of its lower density than water.

STEAM EXTRACTION

Steam extractors all work on the same principle: two connected tanks are fixed, one inside the other or one on top of another. The combs or cappings are put in an openwork metal basket inside the main tank. Steam extraction is a good method for cappings but is less suitable for melting down old combs as it yields only around 80 percent of the wax.

Cleaning the wax in the ways described above will satisfy most wax users. If very pure beeswax is required for special purposes the wax has to be refined.

REFINING BEESWAX

The refining process is achieved by:

1. The wax is washed in hot water to remove honey and to allow dirt to settle out and fall to the bottom.
2. The wax is mixed with fuller's earth (clay) and activated carbon: this starts a bleaching process.
3. The resulting mixture is filtered through a filter-press.
4. The wax is cooled before being formed into slabs or pellets.

The washing and refining process can take up to 30 hours at a temperature of 90 °C.

SLUM GUM

Slum gum is the black residue remaining after the wax rendering process. It is composed of cocoons from the bees' brood cells, wax moth cocoons, excrements from larvae and some leftover wax. If the slum gum still contains a lot of wax, it will form a solid cake when cool. If it is low in wax, it crumbles when dry. Most often slum gum is discarded. It burns well and can be used for firewood in cooking, and to make firelighters. In daytime, it can attract many bees if too much wax is left in it, so if it is used for fires in the open, it is better to use it after dark.

MARKETING BEESWAX

In North West Zambia, beekeepers are harvesting honey and beeswax from bark hives, with both commodities serving as a cash crop for export to Europe. In this system, farmers harvest the honey and the wax at the same time. When groups of beekeepers combine their beeswax harvests, they can accumulate enough quantity to sell. Beeswax for export should be clean and heated as little as possible. Little processing is required: it can be moulded into blocks, the broken into smaller pieces, which can then be placed in hessian sacks for export. The wax is broken into smaller pieces to prove its purity and to show that no bricks are concealed in the centre of the lump!

MAKING BEESWAX FOUNDATION

Tray-style foundation press

This is a press into which molten beeswax is poured and moulded on each side with the pattern of foundation. These presses can be made of metal, plaster of Paris, or plastic, and tend to produce rather thick sheets of foundation.

Roller methods

A flat sheet of wax is run through embossed rollers, resembling the clothes mangles used in laundries. Some commercial foundation manufacturers have sophisticated machines in which liquid beeswax is poured straight on to a water-cooled roller embossed with the hexagonal cell pattern. The wax is solidified and printed simultaneously. The sheets of embossed wax are then cut into the rectangular sizes needed for frame hive beekeeping.