African Organic Agriculture Training Manual

A Resource Manual for Trainers

10-1 ORGANIC BEEKEEPING

Draft Version 1.0
June 2011

Ready for field testing

FiBL

IMPRINT

Publisher:
FiBL, Research Institute of Organic Agriculture, Switzerland, www.fibl.org

Collaboration:
› IFOAM, International Federation of Organic Agriculture Movements, Germany, www.ifoam.org
› NOGAMU, National Organic Agricultural Movement of Uganda, www.nogamu.org.ug
› FENAB, Senegal
› OPPAZ, Organic Producers and Processors Association of Zambia, www.oppaz.org.zm

Responsible authors of the unit:
Munshimbwe Chitalu (OPPAZ), Salvador Garibay (FiBL), Brian Ssebunya

Reviewer:
Thomas Amsler (FiBL)

Illustrator:
Okudi Deogratius Gerard and Andrew Baingana

Draft version 1.0, September 2011.
This is an interim version. Comments and recommendations for improvement are welcome.

The production of this manual was funded by the Bill and Melinda Gates Foundation and the Syngenta Foundation for Sustainable Agriculture with the goal to promote organic farming in Africa.

The African Organic Agriculture Training Manual is based on research funded by the Bill & Melinda Gates Foundation and the Syngenta Foundation for Sustainable Agriculture. The manual's findings, conclusions and recommendations are those of the authors, and do not necessarily reflect positions or policies of either Foundation.

Please cite this publication as follows:
FiBL (2011): African Organic Agriculture Training Manual. Version 1.0 June 2011. Edited by Gilles Weidmann and Lukas Kilcher. Research Institute of Organic Agriculture FiBL, Frick

ISBN 978-3-03736-197-9

CONTENTS

10-1 ORGANIC BEEKEEPING

Learning targets for farmers:

- Understand how to manage bees according to their needs, to the bee colony cycle and the expected bee products.
- Understand the importance of being proactive in order to multiply bee colonies and expanding production instead of waiting for natural swarming of the bees.
- Understand that regular monitoring of bee activities is important to avoid absconding and swarming of bees, and to ensure a healthy colony.
- Recognize that by providing enough foraging sources and hive space for the bees at the right time of the bee colony cycle, honey yields can be greatly increased.

1. Introduction

Beekeeping describes the skill of keeping bees for income and food. Beekeeping offers a good opportunity for farmers to start up a small-scale business. Bees produce several products including honey, beeswax, pollen, propolis, royal jelly and venom, which all have various applications. The demand for bee products is increasing at the national and international level. In addition, beekeeping benefits the environment and agricultural crops. It does it in the following ways:

- **Pollination of agricultural crops**
  Bees play an important role in the pollination of many flowering plants and crops. They improve yields and quality of both field and horticultural crops. They are of special importance in coffee, cocoa, mango and avocado.
- **Conservation of biological diversity**
  Pollination of wild plants increases their seed production and thus contributes to their maintenance and to conservation of natural biodiversity.

TYPICAL SITUATION

Challenges related to beekeeping in Africa

African honey is in demand within Africa and around the world. However, both local and export demand are not sufficiently met due to the highly erratic supply. The supply is generally affected by inefficient production and poor processing and handling of honey, as well as lack of collaboration among beekeepers for processing and marketing. The challenges in beekeeping in Africa include:

- **Low returns from beekeeping** – Many farmers have left beekeeping because of lack of profits and low yields and due to the amount of work and the investments that are required for hives and equipment.
- **Poor apiary husbandry** – Especially in the migratory beekeeping system, but also in fixed apiary system, bees are left to look for their own forage, water and to provide their own security from invaders. During times of scarcity, like dry seasons, hives swarm and abscond and hence the farmer loses potential yield from such hives.
- **Pests and diseases** – The varroa mite as well as other pests and diseases are threatening beekeeping in Africa, and farmers lack knowledge on their proper management.
- **Poor harvesting methods** – Rudimentary harvesting methods, for example, using too much smoke or burning the hives leads to destruction of the bee colonies as well as to contamination of the honey harvest.
- **Quality control challenges** – Due to limited availability and improper use of harvesting equipment, honey becomes susceptible to contamination and adulteration. The resulting low quality honey cannot enter the formal market chain, but ends up in the informal markets being used as an ingredient for making local brews or herbal products. Sanitary requirements have also greatly affected honey export to premium markets.

However, beekeeping is still an important economic activity and a potential source of income for farmers in Africa. It is, therefore, necessary to devise means to improve production and returns from beekeeping.

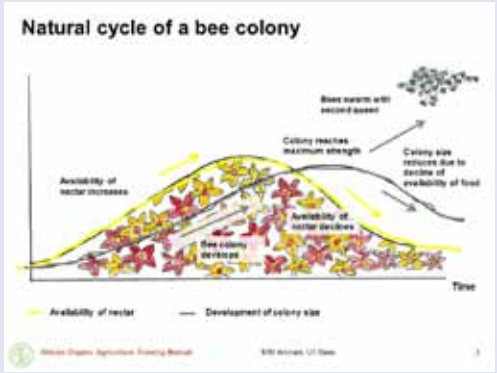
This chapter provides basic information on sustainable and profitable beekeeping and processing.

Discussion – Assessment of the local beekeeping situation

Inquire among the farmers about their knowledge of beekeeping. Have they experienced any of the above or any other challenges? How important is beekeeping to the community? Are bee products commonly in demand?

IMPROVED PRODUCTION

BEE COLONY CYCLE



2. Improving honey production

The yield from a beekeeping enterprise depends entirely on the way bees are managed. Therefore, farmers should actively be involved in the activities of bees. They should know, what the bees are doing or planning to do at all times. Proper monitoring and quick intervention are keys to successful beekeeping.

How a colony develops is strongly associated with the weather, pollen and the availability of nectar. Colony strength peaks at the time of high nectar flow, and if this happens, high yields of honey can be obtained. With plenty of pollen supply and nectar flow, the queen bee is fed more and as a consequence she lays more eggs. On the other hand, when there is scarcity of food, bee workers will feed the queen less, and as a result she lays fewer eggs and the bee population declines. Generally, when the peak colony strength reaches its maximum, most brood cells are capped and honey is gathered in the honeycombs. Eventually, the space for bees becomes scarce, and there is less space for the queen to lay eggs. The queen then expels her pheromone and the colony gets ready to swarm.

In addition to proper monitoring of bee activity, successful beekeeping and honey production depend on proper establishment and maintenance of the apiary, as well as proper harvesting and processing of honey and wax. Good management includes selection of appropriate sites, providing appropriate foraging areas, filling empty hives, working with suitable equipment and tools, avoiding disturbances from humans and animals, keeping the apiary clean, and ensuring proper management of pests, diseases and other nuisances.

2.1 Establishing a new apiary

Successful beekeeping requires a well planned and suitably located apiary. Establishing a new site requires more investment. But it offers the opportunity for the farmer to plan and properly lay out the apiary.

a. Selecting a suitable site for beekeeping

Most importantly, the environment for beekeeping should consist of diverse vegetation that provides plenty of pollen and nectar. Ideally, the apiary is located within a 1 km radius of food sources. In addition, there should be a source of good water in the immediate area since bees need as much water as pollen and nectar, and a colony may drink up to several liters of water a day. In case there is

Discuss developments in local beekeeping

Ask the farmers:

- Have you set up an apiary?
- What do you consider when setting up an apiary in a given location?
- How long do apiaries remain productive?

SITE SELECTION

no natural source of water the beekeeper must frequently provide fresh water for the bees by filling a shallow tub with fresh water and placing some straw or twigs inside so that bees have something to land on and can access the water without drowning. With a source of water near the apiary, the bees do not waste much energy searching for water, but instead save it for sourcing more nectar and pollen. The area should also be free from flooding and protected from extreme hot or cold weather conditions. The site should also be far enough from human settlements, livestock and agricultural activities, especially because African bees have strong protection instincts and easily attack when disturbed.

Precaution must be taken especially in areas with intensive application of chemical pesticides. The bees can be poisoned and the resulting honey contaminated. Organic beekeeping should not be practiced on farms and in areas where genetically modified crops are grown to avoid risk of contamination with pollen from GMO plants.

Recommendations to farmers for selecting apiary sites:

- Protect the hives from intense sun by placing them under shade trees, or by placing shade materials on top of the hives.
- Protect the hives from wind by placing flight entrances away from the prevailing winds. If this is not possible, plant or construct wind breaks around the apiary.
- Protect the hives from toads, snakes, domestic animals, ants, termites and other invaders by placing them 1.5 m above ground nicely secured with wire.
- Protect the hives from rain by placing them at an angle such that the flight entrance is at least 1 cm below the rear of the bottom board. This prevents water from flowing into the hive. Also avoid placing hives very close to water bodies to avoid extreme humidity.
- As a rule of thumb, bees should be kept 100 m away from settlements, livestock and busy roads in forest areas, 200 m away in shrubby areas and 300 m away in open areas.
- Protect hives from chemical poisoning by situating them at least 3–4 km away from conventional farms growing crops with potentially high pesticide levels such as melons, cucumbers or tomatoes, and from GMO plants such as maize and soybean.
- Bees react aggressively to noise, therefore, vibrating objects such as machines, soil cultivation, the action of weeding and cutting grass disturbs the

Sharing experiences on site selection for beekeeping

Ask the farmers, what they consider when selecting sites for beekeeping. Do they have any special experiences with different types of locations? What is an ideal location for beekeeping in the local context?

bees when they are close to them. Therefore, ensure that the apiary site is not near such activities.

b. Choosing suitable beehives

The hive is the bees' home. An organic hive is made from natural materials such as wood, bark, clay and mud or a basket. There are three major types of hives commonly used in beekeeping:

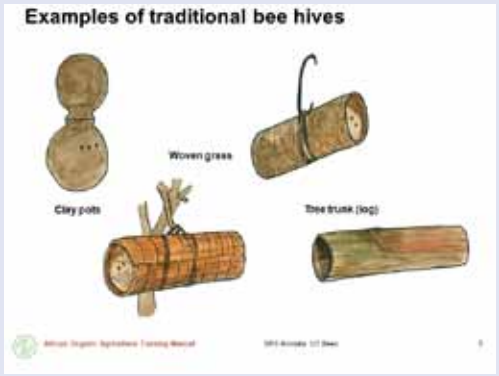
- Fixed comb hives
- Removable comb hives with top-bars
- Removable comb hives with frames

Fixed comb hives, also known as 'traditional hives', are cheap and normally constructed from locally available materials such as clay or mud. However, they only last for about 2 years and do not produce good quality honey. This is because during honey harvesting, the beekeeper normally crushes the honeycombs and kills many bees when the combs are cut out. If the honey is not well filtered, it may contain pieces of bee bodies. Traditional hives have low productivity producing between 6 and 10 kg of comb honey per season. The use of traditional beehives is, therefore, not encouraged in organic beekeeping, because they are inefficient and can cause serious environmental damage unless their construction is improved.

Top-bar hives are removable comb hives made from properly sawn timber. They are long boxes carrying a number of planks on top, called top-bars. The bees are expected to build a comb down from each top-bar. The advantages of top-bar hives include:

- Each comb can be accessed independently without disturbing the others. This enables easy inspection of the development of the colony and the quality of the honey. Combs with ripe honey can be removed without disturbing other combs, thereby allowing the colony to develop well.
- Top-bar hives are relatively easy to make and can be made locally with locally available and inexpensive materials. If they are made locally, it is important that the standard width of the top-bar is kept the same as the natural comb made by the bees, which is at 32–35 cm depending on the type of bee. This ensures that bees are able to build combs right below each top-bar.

TRADITIONAL HIVES

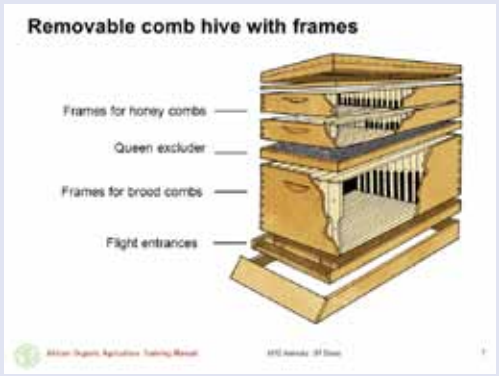


HIVES WITH TOP-BARS

Sharing experiences on the appropriate type of beehive

Ask the farmers, which beehive is commonly used in the area. What are the farmers' experiences with the different types of hives used? Record the advantages and disadvantages of the different types of hives and guide the choice of the most suitable type(s) for the area.

HIVE WITH FRAME



However, top-bar hives require careful handling, as the combs can easily break off the top-bar and be destroyed.

Removable comb hives with frames – Two common removable hives with frames used in Africa are the 'Langstroth' and 'East African Long' hive. In these types of hives, the bees build their combs on a wax foundation fixed in a wooden frame. This creates a foundation sheet with a 2 to 3 mm layer of beeswax, a little smaller than the inner measure of the frame, on which a pattern of hexagonals have been imprinted with a press. This sheet is fixed vertically in the middle of the frame encouraging the bees to build cell walls horizontally on both sides of the foundation sheet. After harvesting, the honeycombs can be reused for many seasons. The combs with brood (young bees) can easily be separated from combs with honey by using queen excluders.

c. Selecting a beekeeping system

Beekeeping can be done by either moving with the bee colonies to places with flowering plants, or by keeping the bees in a fixed apiary.

i. Migratory beekeeping

In migratory beekeeping the beekeeper transports the bee colonies to locations where flowering plants are present. This practice is encouraged in areas where the bee forage is spread over a large area of land. The migratory practice allows the beekeeper to harvest honey more than twice a year and thus to yield more honey. However, this practice requires that the beekeeper knows the time of flowering in different locations in order to plan the movements well during the year. Timely and safe movement of the colonies is important. For this, collaboration with other beekeepers can be helpful. To avoid losses or damage during transportation, the entrances of the hives should be closed properly (to be done when the bees are no longer flying), the hive and its cover should be well secured with a rope to avoid moving the hive and preventing the cover from opening. It is essential to drive slowly on bumpy roads. Transportation should be done at night or very early in the morning, when temperatures are low. The new site should have a natural source of water nearby, otherwise water should be supplied at the new place.

ii. Fixed apiary system

Bees can also be kept in a permanent bee yard called an apiary. The apiary is set up in a location with a permanent supply of flowering plants and water

Discussion on the beekeeping system

Ask the farmers which beekeeping system they use in the area. What are the advantages and disadvantages of the two systems in the local situation?

How is migration planned in the migratory system according to the nectar flows in the region based on the type of flowering plants and the quantities of honey obtained.

How are the main activities planned in the fixed systems during the beekeeping calendar?

throughout the life cycle of the bee colonies, with easy access but also hidden in order to avoid hives from being stolen. This requires careful selection of the location. The number of bee colonies or hives should depend on the amount of pollen and nectar available. In some cases it may be necessary to bring water to the apiaries and increase bee foraging by planting different flowering plant species around the apiary.

A beekeeper can have several apiaries and organize apiary inspection and honey harvesting in a planned way. Apiaries can also be integrated within the farm, in order to benefit from flowering agricultural crops, especially fruit crops like mangoes, citrus, guava and others. Having agricultural crops as a source of pollen and nectar minimizes swarming and absconding, because crops provide pollen and nectar at different times of the year than natural forests. Precaution must, however, be taken especially in agricultural areas to prevent poisoning of bees through pesticides that are applied to crops.

d. Proper construction of a beehive

- Beehives must be made with great care, ensuring that there are no openings apart from the flight entrance to ensure protection from robber bees.
- The outside surface of the hive should be painted with natural substances such as plant oils such as linseed oil or coconut oil. Synthetic paint materials should be avoided because residues can be absorbed by the honey and the wax. In case plant oil is not available, water soluble paint can be used.
- Organic honey must be free of any foreign odours. Therefore, no paints should be used inside the hive to avoid absorbtion of the paint by the honey and the wax.
- The hives should be distinguishable from one another in order to reduce the chances of bees mistaking their hives. This can be done by putting a stone on the top of the hive, marking different geometrical figures above the flight entrance of the hives or painting the flight board in different colours (use only water soluble paint material). If there is no way of making the hives distinguishable, then sufficiently separate the hives from each other.

e. Encouraging bees to occupy the hives

Ordinarily, bees should occupy hives on their own. However, the farmer can encourage quick occupation by creating suitable conditions for the bees to move in

Exercice: Making of a beehive

Share experiences with the farmers on the making of an improved beehive.

If appropriate, show the farmers, how a top-bar hive is made indicating the details that need to be considered.

PREPARING A NEW HIVE

CAPTURING A BEE SWARM

or by placing a well baited small hive - what is known as a bait hive - in a suitable place. All that is needed is an empty, old hive with 3 or 4 old drawn combs in it. The old combs attract the attention of the bees through release of pheromones. Bait hives can also attract a bee colony that wants to swarm.

Besides using old combs, aromatic substances can be used for baiting. Orange, lemon or lemon grass oil can be rubbed onto the interior surfaces of the hive, or the melted wax from a burning beeswax candle is dripped along top-bars or rubbed onto the interior surfaces. The residue of the beeswax rendering process, known as slum gum, is also a useful attractant. Additionally, a few drops of queen mandibular pheromone can be put in the bait hive. This pheromone can be obtained from an old queen by putting her into a jar of alcohol, whenever the queen is changed.

The same day the swarm occupies the hive, the baited hive should be moved to the apiary site, because bees orient themselves to the hive the very first day they occupy it. If the swarm does not occupy the hive, the swarm should be moved into a new hive. It is recommended to put a comb with honey into the new hive in order to feed the bees in the first days.

Recommendations to beekeepers on how to capture and move a swarm:

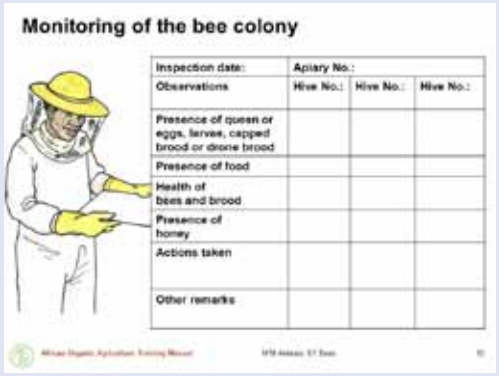
- Ensure safety by wearing proper protective clothing before working with bees.
- If it is in an easily accessible, smoke or sprinkle the swarm with cool water to make the bees more docile.
- Shake or brush the swarm into a suitable collecting material such as a swarm box, a basket or a box.
- Move the swarm immediately and shake them into an empty hive.

f. Management of beehives

When the hives are occupied and the bees are busy, good hive management is essential for proper development of the colony. Good hive management practices include:

- Proper planning of work, including making sure all needed materials such as frames or additional hives are available.
- Working fast, but calmly and smoothly, removing lid and top-bars gently, and blowing smoke gently around the flight entrance.
- Providing extra room, when bees have filled all the bars with food and brood.

MONITORING



› Separating the honey area from the brood chamber with what is called a 'queen excluder' – this prevents the brood from developing in the honey chamber.
› Removing old combs from empty hives.

g. Regular inspection of the bee colony

The hives need to be inspected regularly in order for the beekeeper to build awareness of the condition of the colonies. Inspection should include the following points:

› How is the brood developing in the different stages (eggs, larvae, capped cells)?
› Are all cells filled with honey or pollen?
› Are the bees gathering nectar, pollen and propolis?
› Are any pests, diseases or nuisances disturbing the bees?

Answers to these questions from monitoring, as well as any activities carried out, should be noted on the monitoring record.

Recommended procedure for the inspection of bee colonies:

› Inspect the colonies regularly, ideally on a bright sunny day, to see whether the bees are working normally.
› Light the smoker and approach the hive from the side to avoid blocking the flight entrance.
› Blow a little bit of smoke into the flight entrance while opening the hive calmly and blow a little smoke under the cover. Wait a minute to prevent many bees from leaving the hive when you are inspecting the combs, and to partly protect the colony from robber bees. Place a wet cotton cloth over the opened hive.
› Use the hive tool to loosen the frames.
› Take out the top-bars or frames and hold them above the hive in a vertical position to prevent the queen from falling outside the hive. Inspect one frame at a time.
› Always wash your gloves with water before moving to the next hive or to another apiary to avoid spread of diseases, and disinfect the hive tools in a lighted smoker to prevent transfer of spores between the hives.

Discussion and exercise on catching a bee swarm

Ask the farmers to explain how they catch swarms and occupy hives with a swarm. Use some materials mentioned above and demonstrate to the farmers how to do it, if necessary. Discuss any new methodologies that have been used for encouraging bees to occupy hives.

PROPER BEHAVIOUR

Proper behaviour during the inspection of the apiary – recommendations for beekeepers:

Most bees will not attack, if they are not provoked. A bee will usually only sting in self-defence or to defend its colony.

- Bees react aggressively against smells such as perspiration, alcohol, soap and perfume. Therefore, such smells must be avoided when working with bees. Take a bath before working with bees, especially if you have been sweating.
- Take care not to squash any bees when working in the hive. Squashed bees release an alarm odour causing other bees to attack.
- Bees are attracted to darker colours when they are aggressive and, therefore, easily attack humans wearing darker colours. Therefore, wear white clothing or any light colour.
- Always have smoke at hand anytime you work with bees. Always blow some smoke into the flight entrance first before you open the hives. Make sure that you always have enough smoking materials for the smoker at hand. However, avoid heavy smoke, as it will give the honey a smokey taste and affect its quality.
- Limit the working time in an apiary to 45 minutes, as bees from the first hive that was worked on will become agitated after this period and attack leading to further commotion amongst all the bees.
- Visit the hive during late afternoon in cool months and early in the morning in warm months when temperatures are cool and bee activity is low.
- Bees are very sensitive and react aggressively to rapid movement and noise. Always carry out all activities calmly and slowly. Do this even when you get stung to avoid more stings. When you get stung, remove the bee and then scrape the sting out of your skin with a fingernail or a sharp object. The swelling reaction to stings becomes less frequent as your body becomes more used to stings. However, if your body shows intensive reaction to bee stings, you must stop exposing yourself to bees.

2.2 Improving management of an existing apiary

a. Providing appropriate foraging areas

Availability of nectar depends on many factors such as climate, weather and soil conditions. The beekeeper must recognize, if the location offers appropriate

conditions for sufficient nectar production. Beekeepers must learn to identify the species of trees, bushes and herbs that produce nectar and to evaluate, if the local conditions provide sufficient food for the bee colonies throughout the year. Among the good forage trees are *Acacia* spp., *Gliricidia sepium*, Jacaranda and Leucaena. Proper knowledge of forage plants for bees will help the farmer to estimate the need for supplementing the foraging areas with additional forage plants. Experienced beekeepers or advisors may help to provide information about appropriate forage plants and their flowering behavior throughout the seasons.

b. Filling the hives and creating new colonies

i. Natural swarming

Swarming describes the natural division of a colony from a hive to start a new colony. Swarming happens when a colony becomes too large for the hive. In such a situation the queen starts laying eggs into brut cells or cells with honey, and the colony will want to swarm. When bees are hurrying to build queen cells, bee population is close to having reached its maximum level. Queen cells or swarm cells are usually built on the edges of the comb. If during inspection of the colonies queen cells are visible on the edges of a comb, this is a sign for early swarming. A few days before a new queen emerges, the old queen leaves the colony with half of the workers. Swarms usually fly in the same direction and look for suitable places to start a new colony. If the colony was very big, a second swarm can occur after the initial swarm. The new virgin queen again leaves the hive with half of the colony.

ii. Reducing swarming

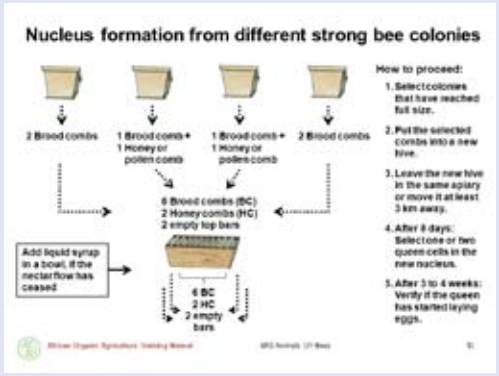
There are simple possibilities to reduce swarming before or after honey harvest. Swarming, however, offers an opportunity for the beekeeper to produce new colonies. The swarming process can be influenced in such a way as to obtain both good honey yields and new colonies.

During nectar flow, the beekeeper should inspect the colonies regularly up until 7 to 10 days after the honey harvest. Space should be provide early enough to store the nectar and for the queen to lay eggs by adding frames or top-bars around the brood nest. This will increase the bee population of the colony, strengthen the colony ready to collect the nectar and, hence, give more honey.

Sharing experiences on providing foraging areas for the bees

Define together with the farmers common local forage plants providing nectar. If possible, make an excursion to the fields and identify the nectar plants, study their growth patterns, and estimate the nectar flux in the region. At the end of the exercise, try to draw a calendar showing nectar availability in the different seasons based on the identified nectar plants.

NUCLEUS FORMATION



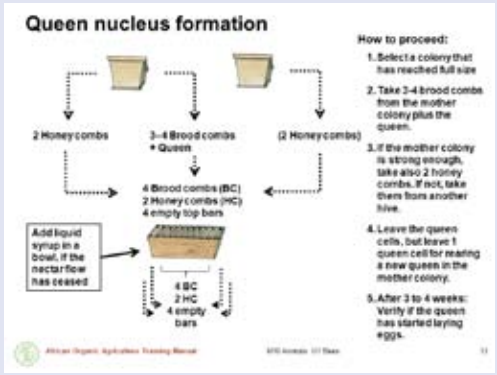
Bee populations can be managed by using any of the following methods:

iii. Nucleus formation from different strong bee colonies

This procedure aims at giving more space to the strong colonies and at temporarily slowing swarming. When the first signs of swarming appear, it is recommended to:

1. Select strong bee colonies (mother colonies) that are ready for swarming.
2. Remove 1 or 2 brood combs along with the bees, avoiding the queen being taken along, and put them into an empty new hive. The brood combs should have all stages of brood, some larvae and some eggs, enough pollen and honey in brood combs. Select brood combs that are not dark to avoid risk of diseases. The amount of brood combs will depend on the hive system used for the nucleus formation. The more brood combs are included in a new nucleus the better. The new nucleus should contain at least 2 food combs (honey and pollen) on the different sides of the brood combs.
3. If at inspection of the mother colonies well-developed new queen cells (almost capped queen cells) are visible, they should be used for the new nucleus leaving one (or maximum two, if they are capped) queen cells in each new nucleus.
   In case the queen cells are not well-developed, eliminate all of them from the mother colonies to avoid swarming. Then, mark one of the inserted brood combs in the nucleus, if it comes from a colony that has good characteristics to work with (e.g. high yielding, not aggressive). Make sure that this brood comb has enough new eggs. If you are lucky the bees will rear new queen cells from this selected brood comb. The size of the entrance from the nucleus should be reduced to avoid bees robbing each other.
4. Check the new nucleus after 8 days and select one or two queen cells, preferably from the marked brood comb.
5. If you leave the hive in the same apiary, the older bees may fly back to the mother colony and only the young bees will stay in the new colony. You can move the nucleus to another apiary at least 3 km away to prevent the older bees from returning to the original hive.
6. Inspect the nucleus to ensure the presence of the virgin queen, and after about 30 days, if the queen has started laying eggs, check for eggs not for the queen. Also check for the construction of combs, food and natural enemies, but do not open too frequently. If possible, supplementary feeding with sugar syrup is recommended.

QUEEN NUCLEUS FORMATION



ARTIFICIAL SWARMING

iv. Queen nucleus formation

If you have a strong colony (mother colony) and during inspection you find well-developed queen cells (strong swarming signs), it is time to divide the colony to avoid swarming.

1. Search for the queen in the mother colony and transfer it with a brood comb that does not have any queen cells to the new empty hive. The queen nucleus can be left in the same apiary or placed in other apiary.
2. Remove about 3 to 4 other good brood combs (capped brood, larvae and eggs, enough pollen and honey in the brood comb) with covering bees from the original mother colony and put in the new hive. Add 2 honey combs from the mother hive or from other strong hives. Fill the empty hive with the necessary frames with a new wax foundation or leave the bees to build wax by themselves (in both frames and top-bars). If there is no more nectar flow, it might be necessary to support the natural wax building by feeding the bees with sugar syrup and to avoid the construction of drone cells in the new colony. The mother colony should be inspected for queen cells, select one (or maximum two queen cells) depending on the strength of the mother colony, in order to assure that a new queen will develop. If you have many queen cells, they can be used for formation of additional nuclei. The size of the entrance from the old and new colony should be reduced to avoid robbery from other bees.
3. After one week, check the new brood chamber to verify if the old queen is laying eggs and no queen cells are being made. Later also check the old colony if a new queen has been reared, mated and started laying eggs (about 30 days). If you wish, you can remove the old queen from the new hive and unite the two colonies by leaving the new young mated queen. You can leave the new colony in the same apiary or move to a new one.

v. Artificial swarming

When the queen cannot be found and there is no time to search for her and well developed capped queen cells are found in the mother colony, the following procedures can be taken:

1. Move the mother colony hive at least 5 meters away during the strong and active times of the day, but not after 4 PM.
2. Place a new empty hive in the old location, which is now free.
3. Put 2 to 3 brood combs with young brood and eggs within 2 honey combs

TRANSFERRING BEES FROM A SMALL TO BIGGER HIVE

(with pollen) into the new hive.
4. Fill the new hive with frames or top-bars.
5. Old bees will fly to the new hive at the old location and will produce a new queen.
6. Check after 8 days for queen cells and leave one for rearing a new queen.
7. Remove all queen cells in the old mother colony, or remove the old queen and leave one queen cell to rear a new queen.

Artificial swarming can readily be combined with the treatment for bee pests and diseases, thus accomplishing different objectives with one manipulation. At the same time new wax is built, new brood developed and the varroa mite can be combated.

c. Prevention of absconding

Absconding is the abandoning of a hive by a colony. Usually this happens after excessive disturbance by predators or beekeepers takes place, or if conditions are not ideal due to lack of forage or water, or excess sun or wind. Absconding is common in tropical species and races of honeybee. Leaving some honey for the colony at harvesting can reduce absconding.

d. Providing extra hive space

Extra space is normally needed when all the combs in the hive are filled with food and brood. Recommendations on the procedure for providing extra hives:

- Move the existing small hive some 50 cm to the side and replace it with a bigger hive.
- Smoke the hive with bees and open both lids of the new and existing hives.
- Loosen the frames with a hive tool.
- Transfer the top-bars with the combs one at a time from the existing hive to the new hive in their correct order, so that the brood nest retains the same shape (look for the queen and any eggs).
- Fill the hive completely by placing additional frames on both sides of the transferred frames. If it is possible, put some combs with honey and pollen to feed the bees.

Experience sharing on managing swarming

Invite the farmers to share experiences on management of swarming. Try to agree on advantages and disadvantages of the different methods.

2.3 Proper apiary management

The ideal number of hives for an apiary depends on the availability of forage and water.
Recommendations regarding proper apiary layout:

- Place the hives near a water resource and in within a distance of 3 km of good forage places, as well as at recommended distances from critical activities.
- Avoid direct exposure to sun selecting a shaded area, and ensuring proper air circulation.
- Plant forage vegetation such as fruit trees and agricultural crops with different flowering times in the neighbourhood of the apiary to expand food sources and duration of honey flow.
- Place the hive entrances away from the prevailing winds.
- Fence in the apiary site to avoid disturbances from humans and animals.
- Keep the apiary clean, cut the grass and prune the trees to protect the hives from disturbing insects and ants.

Equipment and tools needed in beekeeping

Beekeeping requires proper equipment. Beekeepers should have at least the following materials and tools:

- **Smoker** – A smoker is an essential tool in beekeeping and must always be used. The smoker is used to produce smoke to reduce the ability of the bees to fly and sting. Appropriate smoker fuels include cow dung, maize cobs or coconut fibers.
- **Protective clothing** – The purpose of protective clothing is to protect the beekeeper from bee stings. Protective clothing should adequately cover the beekeeper and be of a light colour. Bees are sensitive to colour and often become aggressive when they see dark or bright colours, therefore, these colours should be avoided. All protective clothing must be cleaned regularly with a brush and water to remove the smell of the stings. Smell of stings triggers aggressive behaviour in bees.
- **Head veil** – The head veil protects the head and neck against bee stings. The head veil consists of a broad-brimmed round cotton hat which is under sewn with a black fine mesh measuring 25 cm by 25 cm and a white gauze covering the rest of perimeter of the hat. The veil of the bee hat falls onto the shoulders and is tucked into the shirt or overalls. You should use black mesh or

BEEKEEPING PROTECTIVE EQUIPMENT

HIVE TOOLS

gauze for the window as it is easier to see through black mesh than white mesh.

- **Overalls** – White overalls with a zip fastener must always be used for maximum protection. They must have elastic sown in the ends of the sleeves and legs, or the ends around the wrists and ankles are tied with elastic, rope or sticking tape.
- **Gloves and shoes** – Leather gloves and high shoes that cover the ankles must always be used. An extension piece of 20 cm length with elastic in the ends is sewn onto the ends of the gloves. The shoes must cover the ankles.

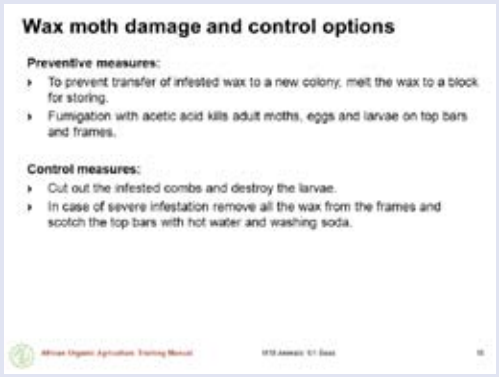
Hive tools include:

- **Hive tool**
  A hive tool is a piece of hard metal, crowbar like, bent and sharp at one end such as a screw driver. This is used to loosen the cover, the honey super (hive body or brood chamber) and the top-bars which have been glued together by the bees.
- **Bee brush**
  A bee brush is a small, oblong brush, a strong feather or the whole wing of a bird that you can use to remove bees from the comb.

Sharing experiences on management of apiaries

Invite an experienced beekeeper to explain how he or she ensures that the apiaries are well managed to minimize losses and improve honey yields. Discuss common good and bad practices and agree on possible improvements.

WAX MOTH



3 Management of pests, diseases and other nuisances

3.1 Common insect pests

a. Wax moth

In tropical areas, wax moths can be a serious problem mainly in stored combs mainly. Therefore, to prevent moth attacks, instead of storing the combs they should be melted and stored as wax block. In case combs are stored, they must be inspected regularly during warm weather. Mainly old, hatched combs with pollen are preferred by the moths. In the hive strong bee colonies are able to control the moths.

In case of moth damage, the infested parts should be cut out and the larvae destroyed. If there is a severe infestation, all the wax should be scraped off the frames and burnt. The frames should then be scotched with a blow torch or soaked in hot water containing washing soda or a household detergent. The hive body should also be cleaned up and scotched. Both the larva and adult moth feed on brown combs in weak colonies which do not occupy all the frames and top-bars.

There are also different substances (e.g. Acetic acid or sulphur) that can be used to control wax moths, however, use of these materials depends on availability.

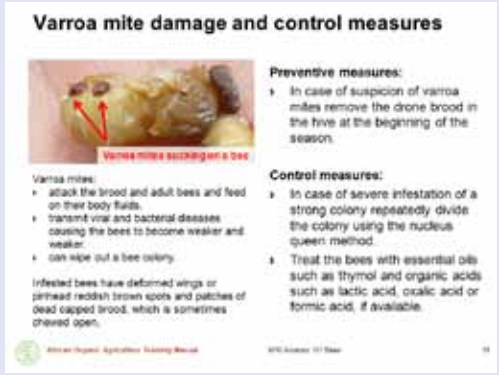
An 80 % solution of acetic acid can be used to control wax moths in stored frames or top-bars. Fumigation with acetic acid will kill adult moths, their eggs and larvae. After the honey is extracted, boxes of frames and top-bars should be piled in stacks, no more than five high. The spaces between the boxes should be taped with paste paper to form an airtight seal. Cotton wool 15 cm by 15 cm or any similar absorbent material soaked in 80 % acid is placed on top of the uppermost frames in the stack before the lid is sealed, using 25 ml 80 % acetic acid per box in the stack. The top of the stack is covered with a hive roof and the stack is left undisturbed for two weeks. The fumigation can be repeated at intervals of 2–3 weeks. Acetic acid must be handled with caution so that it does not come into contact with your skin or eyes. Acetic acid that comes into contact with skin and eyes should be washed off immediately. After fumigation, the boxes of frames and top-bars should be exposed to air for about 2 days before they are used.

Sharing information on pests and diseases in beekeeping

Ask the farmers, which pests and diseases they know or they have observed in local beekeeping. What impact do they have on the bee colonies and honey harvest? How are the pests and diseases commonly managed? Which are the advantages and inconveniences of the prevailing practices?

Build awareness on the relevance of proper pest and disease management in beekeeping.

VARROA MITE



ANTS AND TERMITES

b. Varroa mite

The mites attack both the brood and adult bees and feed on the body fluids of the bees and transmit viral and bacterial diseases causing them to become weaker and weaker. It is a devastating pest and can wipe out a colony if not managed well. Bees infested by the Varroa mite have deformed wings or pinhead reddish brown spots. There are patches of dead capped brood, which is sometimes chewed open.

If Varroa mites are suspected, the following actions are recommended:

- Varroa mites show 8 to 10 times more preference for drone than for worker brood. Therefore, remove the drone brood in the hive at the beginning of the season (at least one per month during the first three months of developing the bee colony).
- In migratory beekeeping or in strong colonies the effect of Varroa mites might be reduced.
- In case of severe infestation of a strong colony with varroa, the colony should be divided using the nucleus queen method. Continuous division of the colony reduces the effect of varroa.
- Essential oils (thymol) and organic acids (§lactic acid, oxalic acid, and formic acid) are also compounds found in nature, and some are used in treating honey bees infested with tracheal mites and varroa. However, use of these materials will depend on their availability.

c. Ants and termites

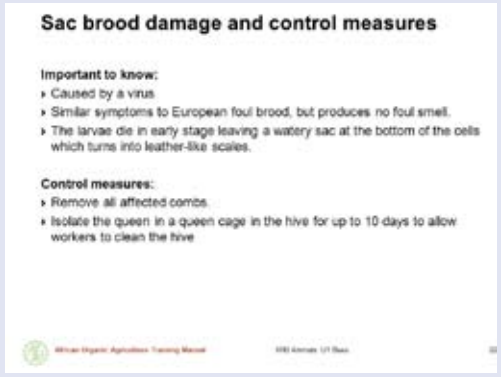
Ants consume the honey and drag the brood out of the hives. Especially 'safari ants' can be extremely destructive to bees. Some ants only attack at night and can wipe out a colony.

To control the ants the following actions are recommended:

- Regularly clear all vegetation and weeds under the hive stand.
- Spray the apiary floor with a concoction of ground tephrosia leaves, chillies or marigolds.
- Dust the floors of the apiary with diatomite. Avoid dusting the above ground and hives as the diatomite has potential to harm the bees.
- Destroy the ant nests in the apiary.
- Hang the hives with wire at least 1 to 2 meters above ground.
- You may oil the points where the hanging poles for the hives are fixed in the ground.

COMMON BEE DISEASES (1)

COMMON BEE DISEASES (2)



3.2 Common diseases of bees

a. European foul brood

European foul brood is a disease caused by bacteria causing death of larvae, decay and stench in the hive. The disease commonly occurs in the rainy season and most colonies recover by the end of the rainy season. European foul brood can be managed by removing all affected combs and by isolating the queen in a queen cage in the hive for up to 10 days to allow workers to clean the hive and release her afterwards.

b. American foul brood

American foul brood is caused by spore-forming bacteria and infects larvae that is about 3 days old or less, causing them to die. The dead larvae decays and produces a glue-like smell. American foul brood can be managed by burning the colony, combs and frames, disinfection of beehives and by restricting supplementation by using honey and by not exchanging frames, bars and hives from other apiaries.

c. Sac brood

This is a viral disease similar in many respects to European foul brood, but it does not produce a foul smell. The larvae die in the early stages leaving a watery sac at the bottom of the cells which turns into leather-like scales. The sac brood can be managed in a similar way as the European foul brood.

3.3 Nuisances in beekeeping

a. **Game and domestic animals** may disturb the bees. Domestic animals, in particular, may suffer considerable bodily harm from bee stings when they tamper with the hives. This can be prevented by carefully selecting a suitable location for the apiary away from the animal and by fencing it off.
b. **Bush fires** are a serious problem in beekeeping as they destroy the forage plants and deprive bees of nectar and pollen causing them to swarm and abscond. Fires also have potential to destroy the hives and bees. This is especially serious with migratory beekeeping in natural forests where the beekeepers do not have absolute control on management of the forest estates.

Bush fires can be prevented by stopping the burning of bushes during the dry season, and by making 3 meter wide fire breaks around apiaries, which prevent the spread of fire.

c. **Chemical poisoning** is a serious threat to beekeeping directly causing death of the bees and resentment by consumers concerned about bee products coming from a poisoned environment. Chemical poisoning comes from industrial fumes and agrochemicals used to kill pests and weeds in conventional agriculture. Chemical poisoning can be prevented by carrying out the following actions:

› Use of natural and organic remedies to manage crop pests and diseases.
› Location of the beekeeping activities on the windward as opposed to leeward side in respect of potential sources of chemical poisoning.
› Location of the beekeeping activities at least 3 km from potential sources of chemical poisoning.
› Dialogue with farmers in the area about developing joint strategies to avoid poisoning of bees.

d. **Honey badger** is an animal that can break into hives to eat honey and brood. You can prevent the attacks of badgers by carrying out the following actions:

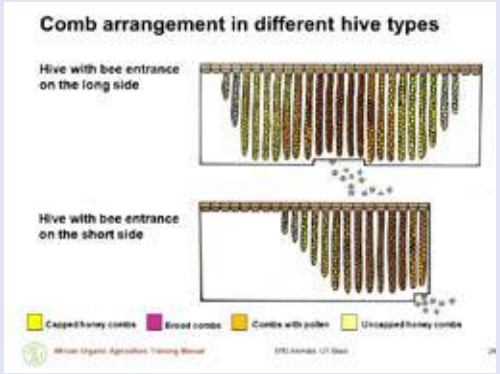
› Hang the hives with wire about 2 meters above ground.
› Tie the lids securely on the hives with wire.
› Alternatively you can place hives in a bee house.

e. **Robbing of other hives happens** during dry periods when bees are looking for honey and sugar. If the invaded colony is weak, it will either be killed in fight for defense of the hive or abscond after a while. You can avoid robbing by carrying out the following actions:

› Always feed the bees inside the hives and avoid spillage of honey or sugar solution outside the hives.
› Allow only one miniaturized flight entrance in weak colonies and close any gaps of the hive.

HARVESTING EQUIPMENT

ARRANGEMENT OF THE COMB TYPES



4 Harvesting honey

4.1 What is the right time to harvest the honey?

Honey harvesting must be done at the right time using the right equipment. Hives should be harvested in 3 to 4 weeks after onset of the honey flow period or according to the honey maturity in the honey comb. Honey flow period is the time when many plants, which provide nectar, are flowering at the same time. The best time to harvest the honey can be determined through regular inspection of the hives or by knowing the flowering time of the majority of plants which supply nectar. Plants which supply nectar are regularly visited by bees. During the nectar collection period bees are in full activity at the entrance during nectar flow and they tend to crowd the flight entrance especially in the afternoons. A gentle knock along the length of the hive producing a solid sound is an indication that combs are filled with honey; a hollow sound is an indication that combs are empty.

Honey should be harvested from capped honeycombs only showing a whitish wax cover. In these combs the honey is completely sealed from outside air, has a low moisture content and stores well for a long period.

4.2 Harvesting the honey

To harvest the honey, proper equipment and care are required to minimize damage to the bee colony, loss of honey and deterioration of quality.

The required equipment for harvesting includes:

- A smoker, a hive tool, a nucleus top-bar hive, new top-bars and a clean cloth to cover the hive with the harvested combs
- Full protective gear

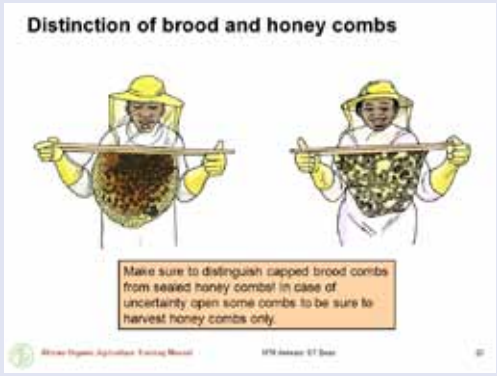
The recommended procedure for harvesting honey is as follows:

1. Make sure to wear the protective gear properly and fire up the smoker.
2. Before opening the hive, gently smoke the flight entrance and wait for a moment.
3. Open the lid, smoke the top of the hive and wait for another minute.

Sharing experiences on harvesting honey

Ask the farmers how they proceed for harvesting honey, in case they keep own bees. Discuss possibilities of improvement.

DISTINCTION OF COMB TYPES



HARVESTING PROCEDURE

4. Separate the top-bars with a hive tool.
5. Inspect the combs and look for the sealed honeycombs. Harvest honey from sealed honeycombs only, which have at least ¾ of all honeycombs sealed. Avoid confusion of honeycombs with capped brood combs.
6. Remove the honeycombs carefully from the hive to avoid them breaking.
7. Carefully remove the bees from the combs.
8. Hang the top-bars with the honeycombs into a nucleus hive to allow safe transportation of the honeycombs.
9. Leave at least one third of the honeycombs unharvested in the hive. They serve as food for bees during the period without nectar.
10. Remove the propolis next to the honeycombs to easen the placement of new top-bars and place it into a suitable container. Propolis is said to have antibiotic qualities.
11. When combs contain a large portion of pollen, it is a sign that you are approaching the brood nest. Do not harvest any brood combs, even if they contain a lot of honey.
12. After removing some of the honeycombs, re-arrange the remaining combs by putting the combs with unripe honey immediately behind the last brood or pollen comb. Then fill the hive with empty top-bars on the outer side. This allows the queen to move easily from the brood combs to the new combs and develop the colony from its center.

5 Processing honey

Processing of bee products must be done in a bee proof space. To avoid that bees enter the room, all openings must be closed with fine wire mesh.
For processing the following equipment is required:

› The use of appropriate **containers** is critical at harvesting, processing and for marketing. For harvesting and processing, containers with capacities of up to 20 kg are used for collecting the honeycombs and for storing the extracted liquid honey. For marketing small quantities of honey to retailers containers of 2 kg to 5 kg are suitable. For marketing larger quantities (200 kg or more), drums with capacities of 200 liter are suitable. All containers and drums used in beekeeping must be of food grade plastic or glass. Plastic containers with sealable tops are desired for collection and storage of honey while glass con-

tainers, plastic or sachets are desired for marketing. To avoid contaminating the honey, no second hand containers should be used.

- A **grading table** is needed to separate dark from light combs. The grading table should be made of stainless steel with a tow lead on both ends. A collecting bucket is placed at each end to separate the dark and light combs respectively.
- **Honey sieves, strainers and filters** are needed for separating the honey from any solid particles. The coarse sieve traps large pieces of capping and wax. The strainer with narrower openings eliminates finer particles of wax and a filter cloth with very fine openings traps grains and other fine particles from the liquid honey. Pollen should not be filtered from honey as it is an important part of honey quality.

5.1 Grading honey

Grading the honey is important to ensure good quality and durability of the mature honey. Grading is done before extracting the honey from the combs. It is done soon after harvesting or at the processing factory on a grading table. Honey quality is graded according to colour, taste, moisture content and HMF (hydroxymethylfurfural) content.

HMF is a break-down product of fructose (one of the main sugars in honey) formed slowly during storage and very quickly when honey is heated. The amount of HMF present in honey is, therefore, used as a guide to show how long honey has been or should be stored and the amount of heating which has taken place. HMF is measured in laboratories only.

Grading according to colour distinguishes high grade honey of light colour in sealed combs and darkish, more yellowish combs containing thicker, second grade honey. The light coloured combs are predominantly sealed honey, while the dark coloured combs contain plenty of pollen cells or unsealed honey. First and second grade honey must be separated and collected in separate containers, as second grade honey degrades easily by fermentation and cannot be stored for a long time. It is therefore best used for quick consumption, for example on the local market.

During grading, the honeycombs are broken into small pieces and allocated to the respective containers at the ends of the grading table.

Demonstration of equipment and proper procedure for processing

Show to the farmers all equipment that is needed for processing honey and demonstrate to them the proper procedure to ensure good quality honey. Share experiences on challenges in the local context and potentials for improvement.

EXAMPLES OF HONEY EXTRACTION EQUIPMENT

EXTRACTION OF HONEY

5.2 Extracting honey

There are four ways to extract liquid honey from combs: floating, pressing, centrifuging using an extractor or by using a honey plant. Whatever method is used, it is important to separate the first grade from the second grade honey. Prior to extraction the wax caps are removed with an uncapping fork or a knife.

Methods used for extraction of honey:

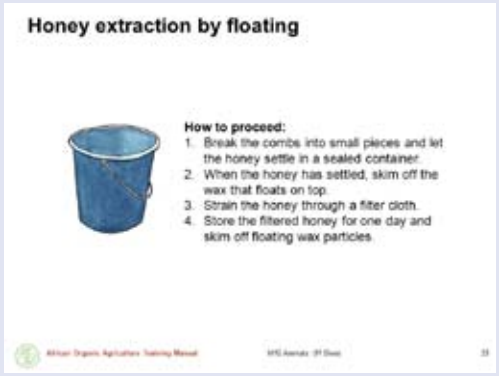
- In the **wax floating** method, the honey is left to settle on the bottom of a container, and wax particles are repeatedly skimmed off from the top surface.
- For pressing honey a simple **honey screw press** is used with a honey chamber and a wooden cover, which is pressed down by a spindle.
- An **extractor** works by centrifuging the honey from the combs. It is a cylindrical container having a centrally moulded fitting at the top to hold the combs or frames of uncapped honey and a honey tap at the bottom. It has a mechanism to rotate the fitting at high speed. Honey is extracted by centrifugal force to the inner side of the cylindrical walls that drop to the base by gravity. It is drained out through the tap near the the bottom and flows into a suitable plastic container.
- A **honey processing plant** is a sophisticated processing unit. It produces the highest grade honey in a hygienic environment. Honey plants are expensive, however, and are only affordable to large commercial honey producers or co-operatives.

a. Floating the wax

Floating is the simplest method to extract honey, but it takes the most time. It is suitable for farmers with no processing facility. The main disadvantage of this method is that in the rainy season, when air moisture is high, the honey absorbs a considerable amount of moisture and as a result loses quality and easily degrades by fermenting.
The following procedure can be recommended to beekeepers:

1. Break the combs into small pieces and place them in a suitable, sealable plastic container.
2. Seal the container to make it airtight and allow the combs to sit for a few days. This step applies to honey collected in proper containers only.
3. Once the honey has settled, skim off the wax that floats to the top.

EXTRACTION BY FLOATING



4. Strain the honey through a clean filter cloth, nylon stocking or special honey sieve.
5. Store the filtered honey for one day and skim off any wax particles which float to the top again.
6. Fill the honey into suitable containers for consumption and marketing.

b. Pressing

Pressing honey is more laborious than floating the wax, but takes less time.

The following procedure is followed for pressing honey:

1. Break the honeycombs into small pieces and put them into suitable sealable plastic containers.
2. Fill the honey press with broken pieces of honeycombs or wax particles.
3. Clamp the press and squeeze out the honey by rotating the pressing clump clockwise until the honey stops coming out. Add more comb honey or wax particles at least three times before removing the pressed combs which contain lots of wax. The honey is collected below the honey press into a suitable container.
4. Filter the honey through a suitable filter cloth to remove any solid particles and pollen grains. The sieved honey collected in the buckets at the grading table is also subjected to this process.
5. Fill the honey into suitable containers for consumption and marketing.

c. Centrifuging

Centrifuging extracts the honey very fast and efficiently. Centrifugal honey extractors exist for frame hives and top-bar hives. The honey is neatly extracted from the combs by centrifugal force during the spinning. Before centrifuging the wax covers are removed by using an uncapping fork.

PROCESSING OF WAX

5.3 Proper storage and packaging of honey

Honey should be stored in cool, dry and dark areas. The honey should be filled shortly after extraction in glass jars with screw-on lids or food grade plastic buckets or food grade metal containers with well-sealing lids. If honey is stored in improperly sealed containers, it will absorb water from the air and ferment easily. To remove excess moisture, honey should not be heated, because heating destroys enzymes and causes a deterioration in taste. Instead, if the moisture level is too high, it can be reduced by blowing air for several hours over a pan of honey using an electric fan. When honey is kept at temperatures below 24 °C, it crystallizes. Crystalized honey has the same nutritional value as liquid honey.

Honey can be marketed as comb honey or as liquid honey. Comb honey is prepared by selecting only sealed pieces of comb which are then cut into neat portions and packaged in suitable containers. Honey in combs is seen to be pure and if presented in this form can fetch high price. It also has a finer flavour than extracted honey.

Honey should be packaged in lightweight, low cost, and preferably transparent containers, so that customers can see the product. Glass and plastic containers or even sachets are commonly used.

Demonstration on processing wax

Demonstrate to the farmers how to process beeswax properly.

5.4 Processing the wax

Most beekeepers don't think about the value of beeswax, although it has numerous uses and sells for almost double the price per weight as honey. In improved hives, beeswax is produced at a rate of 1.5 to 2 percent of the volume of honey. In traditional hives the rate is only 10 to 15 percent of the weight of the honey.

Beeswax is in great demand in Europe, giving beeswax from Africa great potential. Organic beeswax from Africa is known to have very low pesticide content. Beeswax is used for making candles, ointments, medicines, soaps, polishes, lubricants and cosmetics. It is also used in wood and leather waterproofing products, as well as for strengthening threads, insulating high-frequency electrical circuits and in food processing.

Quality beeswax is melted into metal pots of enamel, stainless steel or aluminium. To maintain colour and smell, the beeswax is rapidly heated to boiling

temperatures. A slow heating and a long boiling phase lead to loss of colour and smell. Lightish wax is the most desired and has the highest value.

For marketing beeswax is melted, filtered and molded into blocks, and shipped in unwrapped lumps in Hessian bags. Contact with metal is avoided, as the wax will react adversely with iron and zinc. The only metal containers that are appropriate for beeswax storage and shipment are made of stainless steel.

Recommendations to beekeepers for processing high quality wax:

1. Tie up the wax in a pot of enamel, aluminum or stainless steel.
2. Add twice as much clean rainwater as the volume of the wax.
3. Heat the rainwater with the wax, until all the wax is melted. Be aware that hot wax is easily set on fire.
4. Pour the hot mixture through a rough sieve into a bucket.
5. Allow the wax to cool until it has set hard. This might take 12 hours or more. The wax separates from the water and rises to the surface of the container like a plate. The debris settles at the bottom of the cake wax.
6. Remove the wax when it is hard and scrape the debris at the bottom off the cake wax. Pour out the water.
7. You can repeat the process to get wax of higher purity. Again use rainwater only for cooking the wax.

6 Marketing and organic certification of honey production

The honey market has strict quality and quantity requirements. Common quality parameters used include sugar content, water insoluble solids (impurities) content, mineral content, acidity, diastase activity and the Hydroxymethylfurfural (HMF) content. In terms of quality requirements, honey traders commonly require bulk purchases of high and consistent volumes. Such requirements present challenges to beekeepers working on their own to successfully engage into honey marketing. It is, therefore, recommended that beekeepers work together in groups or cooperatives as a prerequisite to developing a good honey supply chain. Successful marketing of organic honey will then depend on how well the different actors in the market chain are organised and closely working together.

The organic market, whether certified or not, will require the implementation of the following requirements:

- Use natural wax only (from own production) that is free of any residues for your hives.
- Work with a reasonable number of apiaries, depending on the availability of labour and forage.
- Avoid installing the apiary near agricultural areas with intensive use of synthetic pesticides and fertilizers and with GMO crops such as maize and soybean.
- Use natural substances only to paint the hives and make sure all treatments are according to the standards.
- Use natural and organic feed only for supplementary feeding of the bees.
- Refrain from practices that modify the natural behaviour of the bees, e.g. clipping the wings of the queen.
- Protect the hives from direct sunlight, rain and excessive heat.
- Minimise the risk of contamination and adulteration by clearly separating organic and non-organic honey and ensure traceability by properly labelling all batches.
- Use only stainless steel or food grade containers for storage.

For honey producers, who want to be certified, the specific national or international organic standards define additional requirements for production and processing of organic honey. The national organic movement or organic certification bodies operating in the country can provide further guidance and support for organic certification.

Discussion on marketing honey and wax

Ask the farmers which challenges they face in marketing honey and wax. Discuss together how these challenges may be overcome.

Recommended further readings

- Julius Mwale, Beekeeping handbook, Wildlife Conservation Society, Zambia, P.O. Box 530225 Lundazi. E-mail: wcs_lun@zamtel.zm
- Madeleen Husselman, Fiona Paumgarten, Shadreck Sapwe, Paul Kabengele, Wachisa Sibale, Sitwala Wamunyima, Mercy Mupeta Kandulu and Horst Wendorf, 2009. A bee keeping Management guide for Zambia. A manual for extension workers promoting the production and trade of bee-products.
- P. Segeren, 2004. Beekeeping in the tropics, Agrodok 32, ISBN: 90-77073-57-4, NUGI: 835 Agromisa Foundation, Wageningen.
- Munshimbwe Chitalu, 2009. Organic Beekeeping in Zambia
- Munshimbwe Chitalu, Martin Sekeleti, Edwin Abwino, 2010. Beekeeping study circle material (unpublished)
- Munshimbwe Chitalu, Edwin Abwino, Jeston Lunda, 2009. Internal Control Systems Study Circle Material for Beekeeping (unpublished)
- ICTA, 1992. Tools for agriculture. A guide to appropriate equipment for smallholder farmers. ISBN 1 85339 100 X.
- Haike Rieks. 2006. Trainig Manual. Organic Beekeeping. Export Promotion of Organic Products from Africa (EPOPA).
- Thomas Carroll. 2006. A Beginner's Guide to Beekeeping in Kenya. Legacy Book Press. Nairobi, Kenya.
- Khaliso Kepaletswe. 2005. Beekeeping in Botswana. Ministry of Agriculture. Gaborone Botswana.