

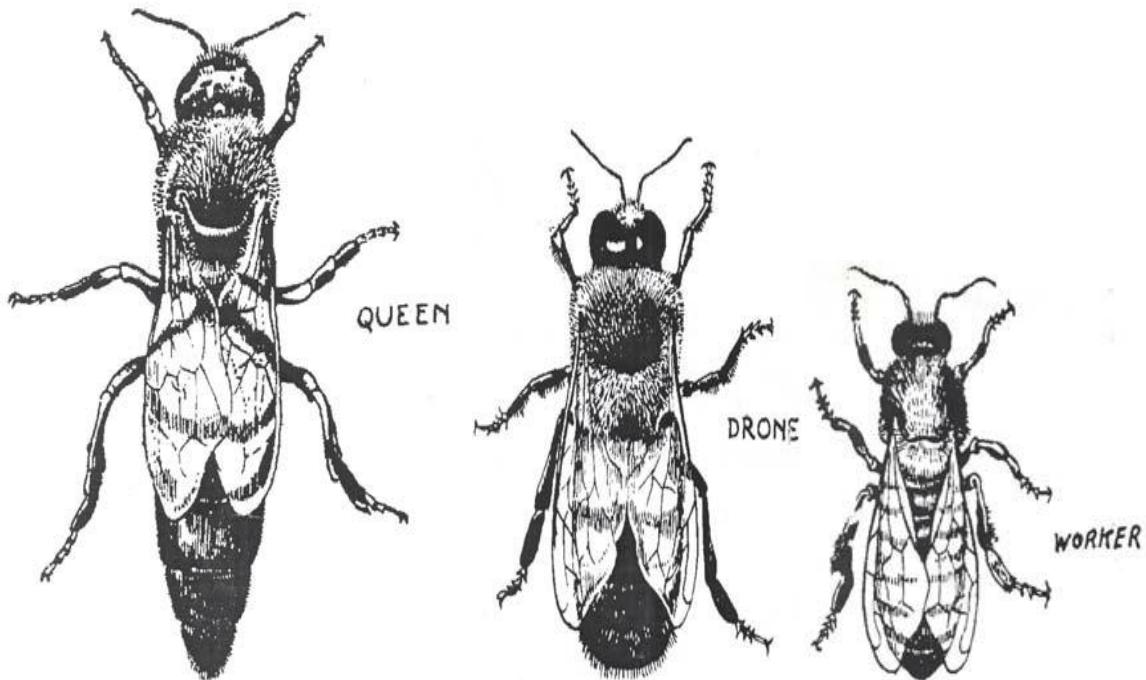


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Bee keeping Training Manual



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SECTION 1

Introduction

There is one livelihood skill which when started can continuously give the rural community income and food at least twice in a year. Its potential as a business is yet to be realised especially for groups wishing to start up small-scale business. It even benefits the environment and food crops being grown by the farmers. The demand for its product never ceases but keeps on increasing both locally and internationally. That livelihood skill is **beekeeping**.

Honey continues to command good prices. There is a market for beeswax and beekeepers can also trade in bees themselves particularly *queens*. Other hive products that can be exploited are *pollination services, royal jelly, and bee venom*.

Aciton for Positive Change helps rural community in offering alternative sources of income and food. We are vigorously pursuing beekeeping in Chipata, Katete, Mambwe, Vubwi and Chadiza Districts in the Eastern Province and Mansa District in Luapula Province of Zambia by providing boxes (modern) and other beekeeping equipments.

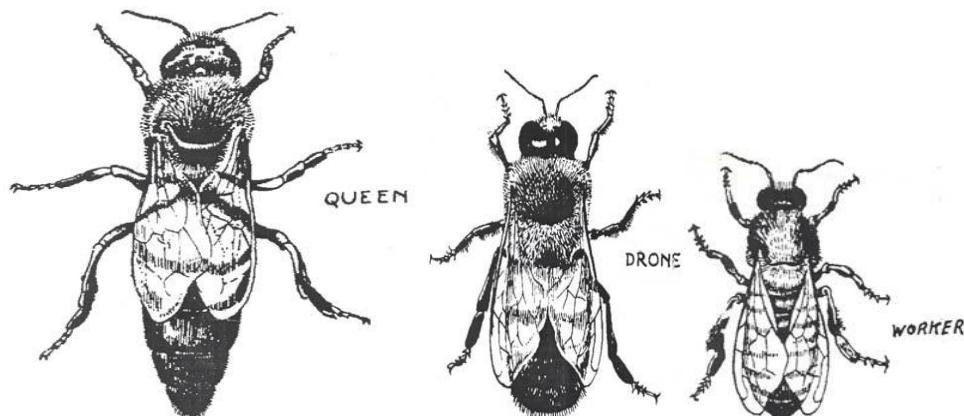
Good management of hives is critical to the increase of honey yields. Therefore, for successful management, beekeepers must understand the bee biology and their behaviour. This guide contains practical information that is highly useful to the beekeeping groups.

SECTION 2

THE BEE COLONY

Honey bees live in a home of wax comb. These six-sided wax cells are very strong and house the brood (immature bees) during development and provide storage space for honey and pollen.

In nature bees usually live in a sheltered cavity, such as a hollow tree or rock crevice. The colony is composed of a queen, drones, and workers.



The queen, drone and worker bee.

The Queen

There is only one queen bee in the colony (family). As mother of the colony, her purpose in life is to lay eggs. She may lay several hundred eggs (approximately 2000) in one day.

These eggs may hatch into drones (males), workers, or new queens. The queen can determine type of egg she is going to lay. She lays only the type that she feels the colony needs.

It takes sixteen days for queen to develop from an egg into an adult. About the seventh day after hatching, the queen flies from the hive and mates with one or more drones. This is the only time in her life that the queen mates, though she may live four to five years.

The queen is larger than the worker and longer than the drone. Her wings are shorter in proportion to her body length than those of the drone or worker. She has a long tapering abdomen. When undisturbed, a mated, laying queen will usually be found on or near the comb containing the eggs in the hive.

The Drone

The number of drone bees in a colony varies seasonally. There may be none when the bees have little food, but up to 1000 during the honey collecting season. When the honey season is over and food and water become scarce, the drones are expelled from the hive.

It takes 24 days for drone to develop from an egg into an adult. The drone does not work in the hive. The duty of the drone that is only male in the hive is to mate the queen and it dies after mating with her.

Drones are larger and fatter than the queen or the workers. Their bodies are not long as the queen's. The drone has a short tongue he uses to take food from workers and from stored honey in the hive. He does not have legs fit to carry pollen and he is unable to produce wax. He has no stinger to defend himself.

The worker

There are 5,000 to 75,000 worker bees in a colony. They do the entire house and field work. Some workers go out of the hive to bring in water, pollen, nectar, and propolis (bee glue). Other workers remain in the hive to guard against the enemies. Still others clean the hive, build wax comb, nurse the young, and control the temperature of the hive. Workers eat honey to produce heat in cold weather and fan their wings to keep the hive cool in the hot weather.

It takes 21 days for a worker to grow from an egg into an adult. During the honey-collecting period, workers have special legs equipped with pollen baskets. They also have glands that produce wax and the scent necessary for carrying out their many duties. Workers are smaller than either the drones or the queen. They have the stinger which when it stings the stinger remains behind and the bee dies.

SECTION 3

BEEHIVES

Bark hives are the most common hives used in most areas. However, this manual does not encourage bark hive because of it is very destructive to trees, but it provides alternatives by using the wooden hives.

To make your own Top bar hive, follow the plans and dimensions in this manual. We emphasise that you keep exactly the same measurements as described here if they are to fit well together.

Top Bar Hives

Top bar hives are long boxes carrying a number of slats on top (top bars). The bees are expected to build one comb down from each top bar.

Top bar hives have the following advantages:

1. The only exact measurements required in construction are those of the top bar itself. Other measurements are not so critical, so that hives can be made with simple tools from relatively cheap local materials.
2. *The size of the hive can vary to suit local conditions.*
3. Every comb is accessible without removing the others. This one-bar-at-a-time technique causes fewer disturbances to the colony and greatly reduces the number of bees flying around when the hive is open.
4. *The brood can be inspected easily, which gives the beekeeper real control over the management of the hive.*
5. The beekeeper can judge the exact time when combs are ready for honey-harvesting without disturbing the brood. The honey is also of high quality as the combs can be selected to be free of pollen and brood.
6. The top bar hive makes it possible to gather good quality beeswax for which there is always a ready market.
7. *No lifting is required other than the combs. The top bar hive can be managed by those who cannot lift heavy weights.*
8. All top bars are at the same level, which can be chosen to suit the individual.
9. If there are predators, hives can be suspended by wires above the ground at a height convenient for operation.
10. *The better management technique promoted by these hives help protect, preserve and increase the bee population. This then benefits the economy through increased pollination as well as honey and wax production.*

How to make top-bar hives

A hive can be made of any wood providing it is:

- Not warped or twisted
- Resistant to the rotting effects of sun and rain

- Very few woods are termite proof and so all hives have to be protected from termite attack.

The hive itself consists of just six parts the measurements that are not critical and hence construction does not require highly skilled labour.

In the wild, bees develop their comb downwards in a gentle curve. Therefore, the sides of the hive need to be at an angle which approximates this curve. This limits the inclination of the bees to attach the comb to the side walls.

The top bars themselves do require critical measurements and uniformity. The bar must be 33mm wide. This is important as the tropical honey bee builds a comb which has a thickness of 25mm. The comb is attached to the centre of the bar thus leaving a space of 3.5mm on each side. When two neighbouring top bars develop combs the gap is 7mm (3.5mm + 3.5mm). This inner space (bee space) is vital to allow the bees to walk freely on the comb. There are two types of top bar hives that Action for Positive Change is promoting:

Tanzanian and Kenyan Top Bar Hives.

Advantages of KTBH over TTBH

The space is smaller hence the colonies will not crowd the hive hence managing them is easier.

Combs do not attach to the hive walls because they have bending sides

The bees can easily fan out moisture

However, the TTBH is easier to make than KTBH

Measurement of the top bars

Length (d) = 50cm

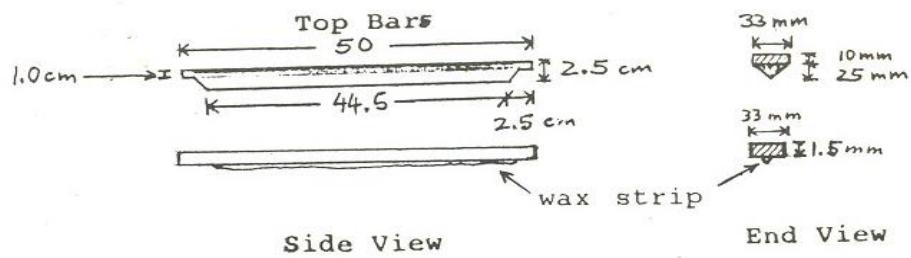
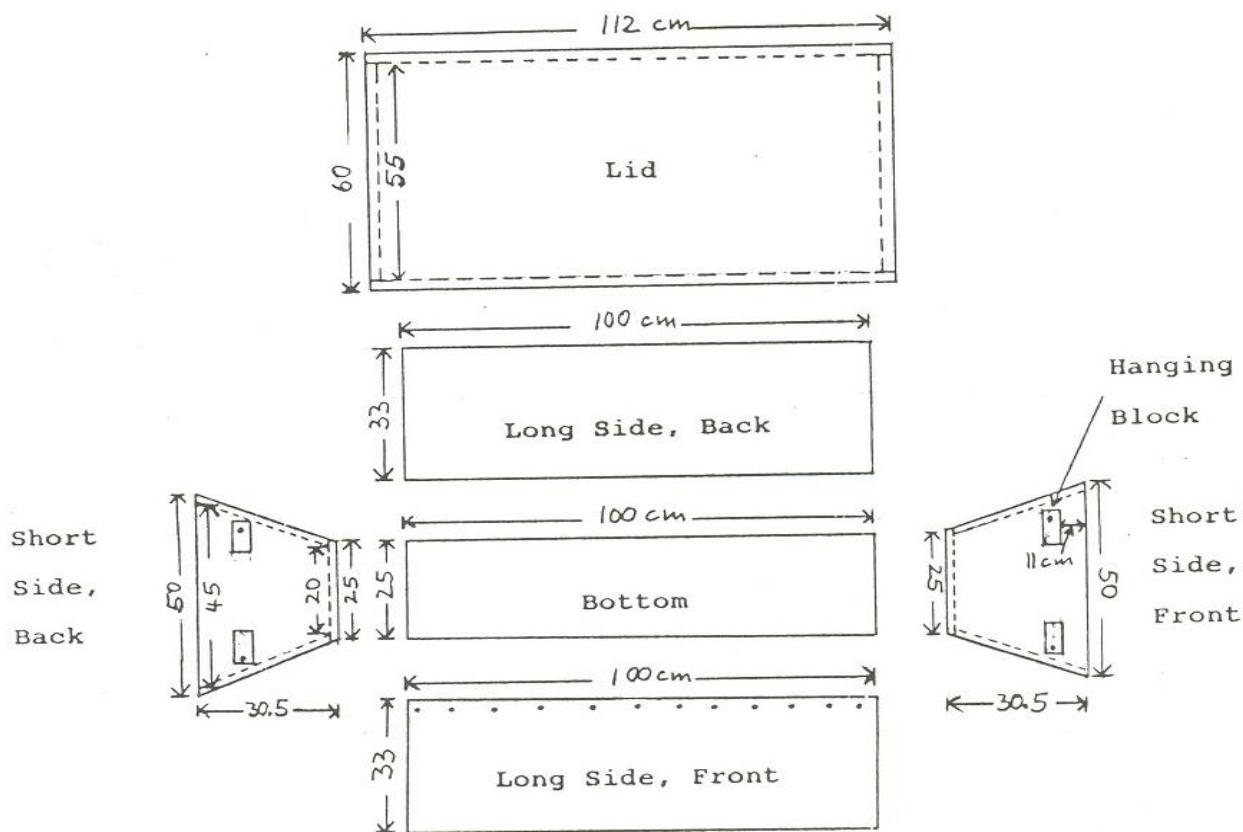
Width (f) = Exactly 33mm

Height (h) = 15mm to support heavy combs

The most significant is the width of the top bars, which must be kept at 33mm. If the space is less, the bees cannot pass through and they can seal it with propolis. If the space is wider, the bees may build combs on it. Therefore, the 33mm width must be adhered to.

2. KENYAN TOP BAR HIVE

Plan of the Kenyan Top bar hive



If hives are to be hung, make a hanging block to balance the hives permanently when they are hanged.

Top bars should be made from high quality wood and they must be made very carefully so that they fit exactly into the hive.

You have to put a *starter strip* along the middle line of every top bar otherwise the bees would have no line for starting the combs.

If you have to apply on the middle of the top bars, you must expose them together with clean beeswax to the sun, fire or make it molten.

LID

The lid protects the top bars underneath. A flat top lid can easily be made by using the dimensions above. It can be covered with galvanised sheet metal, tar paper, or other water proof materials.

To assist ventilation on the top bars, the lid can be lifted a bit by putting sticks on the top bar so that the lid is placed on it.

If it is a lid metal or tar paper or others, you must help the temperature in the hives by placing a thick layer of grass on top of the lid. This protects it from cold and heat.

PAINTING

The outside of the wood can be painted with light coloured exterior paint to protect the wood from weathering (decaying or rotting) quickly. It is recommended to first paint the hive with water paint outside only so as to get a good penetration possibly two coats. Paint should not be applied on the inside of the hive because other than that it is more expensive; the unpainted wood will absorb moisture generated by the colony. The bees themselves coat the inner surface with a thin layer of propolis. Careful painting, and observance of all the manufacturers instructions will ensure proper protection for the hive. For better results two coats of water paint should be applied before oil –based (enamel) is applied.

How to hang the hive

You can place your hive off the ground on a wooden, rock, brick stand or on live stands. Stands should be made strong and must hold the hive in a level position.

The hive can also be hung:

By a wire between two trees

From a branch



An occupied hive. Notice the shade and protection from the sun and strong winds.



An apiary with hives properly hanged with wires. Of special importance is the height at which you should place the hive. You place your hive at your chest height for easier handling of bees.

Top bar hives if possible should be made from light, well-seasoned, good quality wood. The wood should not have a strong smell. The parts of the hive can be glued together with water-resistant glue before carefully nailing the hive.

HOW TO PREPARE A NEW HIVE

You can prepare the hive so that the bees can accept it by rubbing either of the following substance (or a mixture of both) on the inside of the hive:

- Propolis
- Beeswax

Before using them, you can soften it in **hot water**, near **fire** or in the **sun**.

WHERE TO SET UP AN APIARY

It is well known that bees can be kept anywhere. However, if the interest is to increase honey yields and profit margin, the place where hives are placed is paramount to the beekeeper

African bees are defensive in nature hence they must be kept away from the public or a place where they cannot sting anyone. Bees also require food sources that are *nectar* and *pollen* therefore they must be able to find their food sources within their vicinity – at least 2km. While bees can fly many kilometers to look for the food, this is uneconomical when it comes to honey production. The shorter the distance for the bees the more they collect the food.

The apiary must have good air drainage (good air circulation). This means it must have a good airflow. The hives must be protected from strong wind, which may cause drifting of bees. It must also be protected from hot sun by providing a partial shade. Bees need water

and must be able to find the water within 500m. Sometimes water can be provided in containers and to prevent bees from drowning, sticks or stones can be provided for landing and taking off of bees.

To protect the hives from ants and termites, no weeds must be allowed to grow around the hive as they form the bridge for the ants to reach the hive. The scent from weeding usually upset the bees; hence the apiary must be well prepared in advance. During dry spell, a firebreak can be made around the apiary to prevent the hives from being burnt. The apiary must be kept clean and tidy all the time.

SECTION 4

HOW TO MOVE THE BEES INTO A NEW HIVE

Capturing a swarm

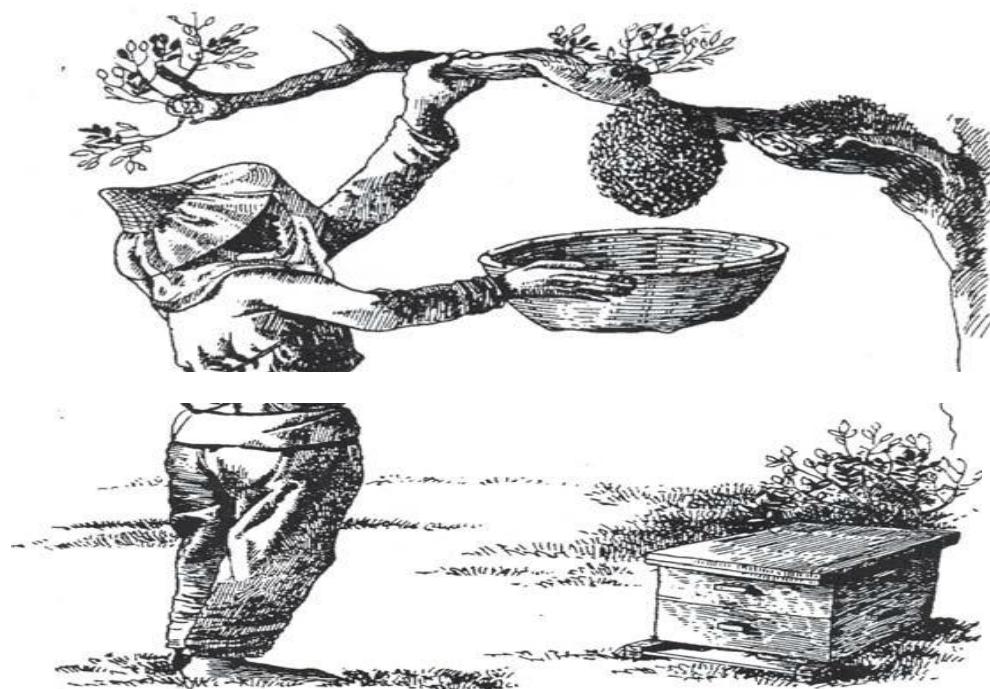
If bees sometimes do not occupy the hive on their own, they have to be moved in the hive. Bees easily occupy hives when they are swarming. Swarming is a process of producing a new colony. Bees swarm for different reasons:

When they are overcrowded before the honey season, they will start swarming.

When the hive is destroyed, food sources or water become scarce

The sudden failure of the queen to lay eggs, a hot or poorly ventilated beehive, lack of space for egg laying and honey storage

Swarm may be found hanging on tree or under hangs of buildings. Once you have located a swarm, it should be caught immediately and transferred to a hive. Brush or shake the bees off into the basket, empty calabash or a cardboard box. Then, shake the bees into the empty new hive.



A beekeeper capturing the swarm wearing protective clothing. After capturing, the swarm can be transferred into the beehive

Unless forced from their home ruthlessly, bees in a swarm rarely sting. However, to make the transfer safe, NEVER brush the bees without smoking but have a veil and smoker ready. After the swarm has been captured, it must be shaken into the new hive and be left undisturbed for a few days. Shortly, the bees will settle down and start storing the food and caring for the young ones. Bees can best be transferred during the honey season (swarming season). The swarming season is immediately during the dry spell after the rain season (probably February –May) and during the spring (August-November).

Using bait hives

A well-baited hive can be placed high on a tree or on a roof. As soon as the swarm has taken occupation of the hive, the bees will begin to orient themselves on the position of the hive. It is therefore advisable to place the hive in its desired place the very day that the swarm has taken occupation of it. If the hive has already been occupied for some days, the bees will already have oriented themselves to the hive. The hive can then only be moved over long distances and some weeks later it can be moved back to the desired place.

It is very expensive to make a swarm box hence other innovations can be employed like card boxes, baskets, gourds.



A swarm box or trap hive is hung high on the tree to trap the bees. After occupation, the bees can be transferred into the main (big) hive.

INSPECTING THE COLONY

The best time for inspecting the colony is a bright, sunny day when the bees are working normally. Bees should not be disturbed on cold, rainy, or windy days or at night.

When inspecting the colony, light the smoker and approach the hive from the side to avoid blocking the bees' entrance. Smoke a bit on the entrance holes especially the busiest. Lift the lid and smoke on the surface and place back the lid. Then it should be removed after a short time and placed upside down. The top bars should be loosened part with the knife, taken out, and examined one by one. The top bars should be handled carefully and always holds the combs vertically to avoid them breaking as shown below.

As you inspect the colony, always be mindful of the queen. The top bar where she may be located must be put back as soon as possible as losing the queen would be tantamount to murdering the colony. Therefore, the top bars must be handled with care and they should be no crushing of bees. **ALWAYS** smoke reasonably after inspecting each top bar to calm the bees.

After you have finished the inspection of the top bars, return all the hive parts to their original positions in the same order as they were taken to maintain the structure of the brood nest. Movable top bars soften the job of checking of combs in a hive as each can be lifted and turned around. While inspecting the hive, all the pest and insects must be removed.

HOW TO MAKE MORE HONEY FROM A COLONY

As Beekeeping producer groups, we must learn many ways of increasing the production of honey with our hives. Experience can make us be aware of the many ways. This manual prescribes some of the ways that can be done to make beekeeping a success.

1. Locate the hives properly.

Always place your hive near good sources of nectar, pollen, and water. In the Luangwa valley, some of the bee tree are: *Musangu*, *Munga-utuba*, *mungobe*, and *Chimphakasa*. In plateau areas like Chipata, *Musamba*, *Kamphoni* etc are good sources.

The supply of water should be within 500m from the apiary (a place where bees are kept in man-made homes or hives). If water sources are scarce, you can provide a shallow water container with taking-off and landing stick or else the bees may be drowning in the water. The hives should be protected from wind and hard rains by placing it where these would be reduced.



Protect the hives from strong winds and sun!

2. Inspecting the colony:

The colonies must be inspected every month. Why? For you to get a good harvest you must look after your field (Hive) by checking the progress inside. Whenever you check your hive, see the supply of honey and pollen, the population and the condition of the queen and brood. Action for Positive Change has designed a data form (Note shown in this Manual) for its producer group to fill and keep record of the progress for their hives. Do NOT check the hive when it is very cold or raining.

BASIC MANAGEMENT

Once the hive is occupied and the bees are busy, then the following simple basics must be adhered to:

- Do not stand in the flight path of the bees
- Work quietly without excessive talking or drumming noises
- Work quickly but smoothly. Remove lid carefully and puff smoke gently around the entrance of the hive
- Remove a few empty bars to create a gap at one end of the hive. This should not disturb the bees. Thereafter, remove one bar at a time. Smoke the gap gently and hold the bar vertically so as not to break off the comb.
- Keep the bars in the same order and try not to squash any bees when replacing them in the hive. Squashed bees release a smell (alarm pheromone) that sets other bees on the attack.
- Do not visit the hive in the warm part of the day – about six o'clock in the evening is a good time.
- Do not try and work with too many hives at any one time. Certainly for not more than 45 minutes in an apiary as bees from the first hive worked on will be agitated and start attack which will lead to further commotion amongst all the bees.
- Always wear light coloured clothes. Ideally protective clothing should be worn, especially a veil to protect the eyes and face.
- Make sure the top bars are pushed together as they are replaced, so that no gaps exist. Finally, gently replace the lid on the hive.
- Always keep the grass cut and the area around the hive tidy.

SECTION 5

CROPPING SEASONS

In Zambia, we usually have two seasons for harvesting honey: April/ May/ June and October, November, December seasons.

CROPPING OF HONEY FROM TOP BAR HIVES

As a good beekeeper, you must know proper cropping of your crops (honey) so as not to waste. Quality honey begins at harvesting and fetch at high price commercially.

To ensure quality, the beekeeper must harvest the honey using plastic containers, smokers, smoking materials, knife, and protective clothings (veil, overall, boot, socks).

It is very important to check the hive before starting harvesting. Only combs that are either fully or half sealed must be harvested.

If possible select comb that are sealed with wax, as it does not ferment quickly because it has fully ripened and does not contain any water.

When harvesting the crops, you must hold the combs vertically so that they are not broken. The top bar must be held over a clean container and cut the entire comb but leaving a 1 cm strip, which will serve as an orientation line that bees would be following when making a new comb. As you harvest the combs, remove the propolis on the sides of top bars before placing them back. Propolis is highly needed for future *baiting* (planting) of hives and must stored safely.

Continue cropping ripe honey till you notice a large portion of pollen. This large portion is cut off and put it in a second grade container. It is a sign that the brood nest is near. Do not harvest a brood comb even it contains a lot of honey as this affect the labour force in the hive.

You should not overcrop as bees may swarm. *Please leave at least 8 combs that will serve as food for bees during the nectarless season.*

Put the combs with unripe honey immediately behind the last brood or pollen comb and then the harvested top bars outside. This allows easier movements of the queen and easier building up of combs from the central part.

CROPPING FROM THE LOG HIVE

When harvesting from the log hive, you must smoke the brood and honey door. After smoking the hive, open the honey door and smoke to avoid bees troubling you.

The combs may either lie vertically or horizontally or both. Remove the combs and brush off the bees before putting it in a clean container. When you discover the brood, you must leave harvesting, as it is the future labour force which must not be disturbed.

GRADING

Immediately, after cropping you have to grade your comb honey before the combs get broken in the cropping container.

Select all the combs which are light in colour and which have mostly sealed honey. Pick off any bees and any dirt, and put the combs into the first grade container.

All the very **dark combs** and combs containing plenty of pollen cells or unsealed honey have to be put into a separate container. They are second grade honey combs. Clean them as well. This grade ferments quickly and must be consumed by the local market. The container with the first grade must be closed tightly.

Difference between the high grade and low grade

Comb honey can easily be distinguished just by observation. The low-grade honey contains *pollen and is darkish, yellowish and thickish* while combs, which *are white or light* in colour, or *mostly sealed* with honey is the first grade.

For quality honey it has to be separated when cropping before they got broken in the cropping container. The honey must not be smoked after cropping otherwise it may be contaminated.

Do not expose honey to water, rain, sun, heat, etc. Remove all impurities like dead bees, grass, or foreign materials. Do not crop during rainy weather. The honey draws moisture from the air and gets watery.

SECTION 6

PROCESSING AND EXTRACTION OF HONEY AND WAX

Comb honey is processed by using the honey presser. The method is less expensive and more economical than the traditional methods which are very wastefull.

The following are taken to press out honey from the combs:

STEP 1: Put wire gauze on the honey press basin and add good amount of comb honey on it, then cover it with the wire gauze. The first wire gauze acts like a strainer so that only liquid honey passes. The last (cover) wire gauze prevents the clamp from sticking to it and work is much easier.

STEP 2: To press honey, rotate the pressing clamp clockwise till the honey stops dripping.

STEP 3: Put fresh amount of honey on the honey press basin and repeat the procedure. You may need to do this 2 or 3 time before removing the pressed combs from the basin.

Remove the pressed combs (which contains wax) by scraping it from the wire gauze with knife and place into container.

STEP 4: Strain the honey using a clean white cloth stretched across a clean container. The process is very slow, but it ensures a clean container. The process is very slow, but it ensures that good quality honey is extracted.

The extracted honey is now ready to be bottled and for consumption. The second grade cannot be stored for a longer period as it ferments quickly but the first grade can be.

The most efficient way to get honey out of the comb is to uncap, or remove the thin cells covers with warm knife or spin out the liquid honey with honey extractor (picture). The honey extractor is made with a drum and basket fitting inside that holds 2 or 4 wooden frames. The honey is neatly recovered and the combs returned to the hive to be refilled with more honey.



Pressing comb honey on the honey presser. The liquid honey is then passed on the white cotton cloth to obtain pure honey. The waste combs are processed into wax.

PROCESSING WAX

The waste combs that remain can be made into wax and should not be thrown away. First, they are washed to remove the sugar from the combs then they are put into a pot of water over the fire. Stir till it mixes forming porridge. Do not allow it to reach the boiling point as the wax on top can burn.

Sieve the mixture using a sack or mesh wire and leave it to cool till overnight. The wax will settle on top and can be taken out.

For commercial purposes, wax can still be processed further and then passing it on the cotton cloth.

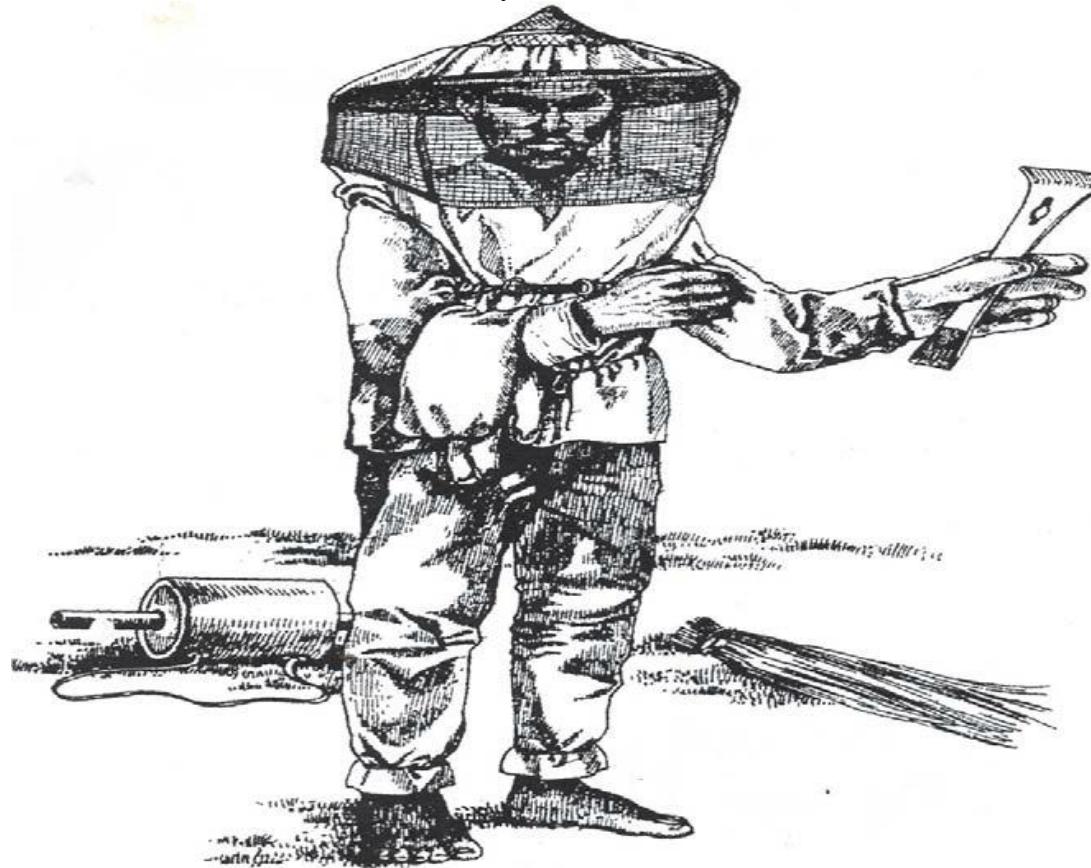
Wax is used for:

- In the making of lotion
- Making of candles
- Baiting in beehives
- Cosmetic purposes
- Making of polish

SECTION 7

BEEKEEPING EQUIPMENTS

For Beekeeping to be successful, the beekeeper will need following necessary equipments in order to work with the bees confidently.



A **veil**, which is basically a cylinder made of net is used to keep aggressive bees away from the face and eyes.

Overalls preferably white in colour should be worn to provide body protection.

Gloves: These are to protect the hands from bee stings. They must be made from soft leather or canvas type cloth.

Smoker: The most valuable tool for working with the bees. It is used to distract the bees. When worker bees smell smoke, they fill themselves with honey. It is difficult for a bee with a full stomach to sting because it cannot double up.

The best material for use in smokers is old, dry sacking or rotten wood, since these burn slowly and give off cool smoke. Rags, cotton waste, wood shavings, cow dung, elephant dung (generally herbivore dung), dried corn cobs, and dry leaves also make good fuel for the smoker. An open smoker can be made for example from a fruit tin, engine oil. A handle has to be attached to the top side because the tin becomes hot. Make holes in the bottom for air inlet. Attach three or four supports to the bottom.

Hive tool /knife: This helps to loosen the top bars which have been glued together by the bees. A piece of hard metal, crowbar like, bent at one end and sharp at the other end will do. You can also use the knife or screw driver.

Bee brush: It is used to sweep the bees from the combs. You can use a small, oblong brush, strong feather or the whole wing of a bird.

SECTION 8

A SIMPLE EXPLANATION OF BEEKEEPING TERMS

APIARY: A place with at least one or more colonies.

BEEMILK (royal jelly): Special secretion produced by young bees (nurse bee) rich in protein, fed to young larvae, the queen larvae and the queen.

BEESWAX: The building material for combs, produced in special glands of young bees.

BROOD COMB: A comb containing cells mainly filled with brood.

BROOD: Collective name for the eggs, larvae and pupae.

CAPPED BROOD: Cells closed by a thin layer of wax and pollen under which mature larvae change into pupae.

CELLS: The little hexagonal sections on both sides of the comb containing brood, pollen or honey.

BEE COLONY: This is a complete biological unit and normally consists of one queen, thousand of workers, a few drones and combs which may consist of honey, pollen, and/ or brood.

COMB: A hanging sheet of wax with cells on both sides.

DRONES: The male bees which develop from unfertilized eggs.

DRONE BROOD: Eggs, larvae and pupae of drones.

FORAGING: The collecting of pollen, nectar and water by bees.

HIVE: An artificial shelter for the bees.

HONEY: Sugary liquid made from nectar, which is split up into more palatable sugars within the honey stomach of the workers and is further processed in the cells.

HONEY COMB: A comb containing only honey.

HONEY STOMACH: The front part of a bee's stomach, used to transport nectar and to change the nectar partially into honey.

HOUSE BEES: The young bees in a colony which have not yet started foraging.

LARVA: In the life cycle of insects generally an egg hatches into larva, then changes pupa from which the adult insect emerges. Larva (plural) of the bees are legs and white, looking like fat curled worms.

MATING FLIGHT: The flight the queen takes for mating.

NECTAR: The sweet juice which is produced by flowers to attract insects in order to get pollinated

ORIENTATION FLIGHT: Flight made by the workers and queens to familiarize themselves with the land marks around the hive so that they do not get lost.

POLLEN: The brightly coloured powder produced abundantly by flowers, rich in protein, fat, minerals, vitamins. Good for rearing brood. Also important part of the diet for adult bees.

POLLINATION: The transfer of pollen from the male parts of a flower to the female parts of another flower (of the same species). Pollination is essential for the development of fruit and seeds. Bees pollinate flowers whilst searching for food.

PROPOLIS: Sealing material collected by the bees mainly out of plant gums. Also used to make the entrances smaller for the protection of the colony. It is collected from the sticky buds, resin drops on tree trunks and branches. It is transported to the hive using the hind legs.

PRIME SWARM: The first swarm to leave a strong overcrowded colony together with the old queen.

PUPA: A stage in the development of the bee between the larva and the mature insect. Pupae (plural) do not eat. They change into adult bees within the silky cocoons spun by the larvae.

QUEEN: The mother of the colony and the only female capable of laying fertilized eggs.

QUEEN CELL: The special large cell, shaped like a peanut pod, in which the queen larvae develops.

SEALED COLONY: This is ripe honey which has been thickened by the bees (moisture removed) and capped with wax.

BEESWAX: The building material for the combs produced in special glands of young workers.

WORKER BEE: Under-developed female. Smallest and most numerous bee in the colony, responsible for organization and all the work.

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