



Ministry of Green Economy and Environment

# Zambia Integrated Forest Landscape Project

Improving lives through sustainable management of natural resources

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## BEEKEEPING USER MANUAL

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# HONEY BEE



## **EXECUTIVE SUMMARY**

The Beekeeping User Manual serves as a comprehensive guide for both novice and experienced beekeepers, providing essential information and practical insights into the art and science of beekeeping. With a focus on sustainability, efficiency, and best practices, this manual covers a wide range of topics crucial to successful beekeeping endeavors. Beginning with an insightful Introduction, readers are introduced to the fascinating world of beekeeping, highlighting its importance in agriculture, ecosystem health, and honey production. The manual then delves into the intricate dynamics of The Bee Colony, offering a detailed understanding of bee behavior, hierarchy, and roles within the hive.

Beehives, the cornerstone of beekeeping operations, are thoroughly explored in a dedicated section, outlining various hive designs, materials, and maintenance practices. Practical guidance is provided in "How to Move the Bees into a New Hive," ensuring a smooth transition for bee colonies and beekeepers alike. Understanding Cropping Seasons is essential for maximizing honey production and hive health. This section offers valuable insights into seasonal considerations, optimal harvesting times, and hive management techniques throughout the year.

The manual proceeds to cover Processing and Extraction of Honey and Wax, detailing efficient methods for extracting and processing these valuable bee products while preserving their quality and purity. Additionally, Beekeeping Equipment is thoroughly examined, with comprehensive discussions on essential tools, protective gear, and hive accessories necessary for successful beekeeping operations. For readers seeking clarity on beekeeping terminology, "A Simple Explanation of Beekeeping Terms" offers a concise glossary, enhancing comprehension and facilitating effective communication within the beekeeping community.

Drawing upon reputable sources and acknowledgments, the manual's Bibliography and Acknowledgments section pay tribute to the wealth of knowledge and expertise contributed by beekeeping enthusiasts and experts worldwide. In conclusion, the Beekeeping User Manual serves as an invaluable resource, empowering beekeepers with the knowledge, skills, and confidence to engage in responsible and rewarding beekeeping practices, contributing to the well-being of bees, ecosystems, and agricultural sustainability.

## **ACKNOWLEDGEMENT**

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The completion of this write-up was made possible through the collaborative efforts and technical contributions of various individuals. Special recognition is extended to COMACO team as TSP which played a pivotal role in the compilation of data, design and composition of this training manual. Their dedication was instrumental in the successful execution of the COMACO TSP contract with ZIFLP.

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## SECTION 1: INTRODUCTION

Welcome to the Beekeeping Manual, a comprehensive guide to the fascinating world of apiculture. Whether one is a seasoned beekeeper looking to refine his/her skills or a novice eager to embark on this rewarding journey, this manual is designed to be a trusted companion, offering a wealth of knowledge, practical insights, and expert advice to help one succeed in the art and science of beekeeping.

Beekeeping, also known as apiculture, holds a special place in agriculture and environmental conservation. Beyond the sweet rewards of honey and beeswax, beekeeping plays a crucial role in pollination, ensuring the fertility and productivity of our crops and sustaining biodiversity in ecosystems worldwide. With the global decline of bee populations posing significant challenges to food security and ecological balance, the importance of responsible beekeeping practices cannot be overstated.

Economically, honey continues to command good prices. There is a market for beeswax and beekeepers can also trade in bees themselves particularly queens. Other Beehive products that can be exploited are propolis, beebread, pollination services, royal jelly, and Bee venom. Beekeeping 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 individuals or groups wishing to start up small-scale businesses because the demand for its products never ceases but keeps on increasing both locally and internationally.

In this manual, we embark on a journey to explore the intricate world of bees, from the bustling activities of the hive to the delicate art of honey extraction. We delve into the social structure of The Bee Colony, unraveling the mysteries of bee behavior, communication, and hive organization. Understanding the dynamics within the colony is fundamental to successful beekeeping, laying the foundation for effective hive management and sustainable beekeeping practices. Central to our exploration is the Beehive, the heart of every beekeeping operation. From traditional wooden hives to modern innovations, we examine various hive designs, materials, and construction techniques, equipping you with the knowledge to select and maintain the ideal habitat for your bee colonies.

As we journey deeper into the world of beekeeping, we'll discuss essential topics such as seasonal considerations, Beehive management strategies, and the delicate balance between human intervention and natural processes. Whether you're harvesting honey, nurturing new colonies, or simply observing the mesmerizing activities of your bees, this manual provides the guidance you need to thrive in your beekeeping endeavors.

So, let us embark on this exciting journey together, as we discover the joys, challenges, and profound importance of beekeeping in our world today. Whether you're drawn to the magic of the hive or the sweet taste of honey, beekeeping offers endless opportunities for learning, stewardship, and connection with nature.

## SECTION 2: THE BEE COLONY

### 2.1 introduction

A bee colony is a marvel of natural engineering, a bustling community of thousands of individual insects working in harmony for the greater good of the colony. Nestled within the intricate confines of wax comb cells, these industrious creatures engage in a multitude of tasks, from nurturing the brood to foraging for resources vital for the colony's survival.

### 2.2 Natural Habitat and Structure:

#### 2.2.1 Natural habitat

In their natural habitat, bee colonies seek shelter in various cavities, such as hollow trees or rock crevices. Within these shelters, the colony constructs its home using hexagonal wax cells. These cells serve as the foundation for nurturing the brood during their developmental stages and as storage units for precious honey and pollen reserves.

#### 2.2.2 Structure - The Three Castes

The colony comprises three distinct castes: the queen, drones, and workers, each with specialized roles crucial for the colony's function and prosperity.

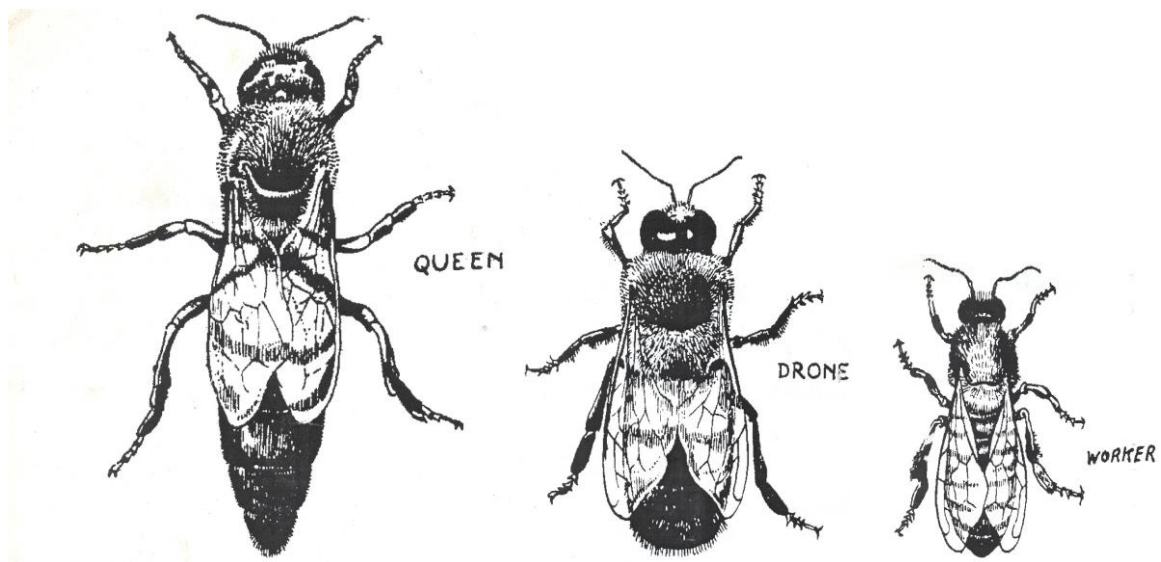


Fig 2.1: The queen, drone and worker bee.

## **The Queen**

In a bee colony, there's just one queen bee, who's like the mom. Her main job is to lay eggs. She can lay a lot, like around 2000 eggs a day! These eggs can become drones (which are boy bees), workers, or new queens. The queen decides what type of egg to lay based on what the colony needs.

It takes about sixteen days for a queen bee to grow from an egg into an adult bee. Around the seventh day after she's born, the queen leaves the hive and mates with some male bees called drones. This is the only time she mates in her life, but she can live for about four to five years.

The queen bee is bigger than the worker bees and longer than the drones. Her wings are shorter compared to her body size than those of drones or workers. She has a long, pointy abdomen. Normally, you'll find a mated queen bee near the comb where the eggs are kept when she's not disturbed

## **The Drone**

The male bees in a colony are called drones. Their numbers change depending on the season. Sometimes there are none, especially when there isn't much food. But during the honey season, there can be up to 1000 drones. When food and water become scarce after the honey season, the drones are kicked out of the hive. It takes about 24 days for a drone to grow from an egg into an adult bee. Drones don't do any work inside the hive. Their main job is to mate with the queen bee. After mating, they die.

Drones are bigger and fatter than the queen or the worker bees. They have shorter bodies compared to the queen. Drones have a short tongue they use to eat food from workers and stored honey. They can't carry pollen or make wax. Also, drones don't have stingers to defend themselves.

## **The worker**

In a colony, there are lots of worker bees, between 5,000 to 75,000 of them. These bees do all the jobs around the hive and outside. Some workers fly out to gather water, pollen, nectar, and something called propolis, which is like bee glue. Other workers stay inside to protect the hive from enemies. Some clean the hive, make new wax comb, take care of the baby bees, and control the hive's temperature. When it's cold, they eat honey to stay warm, and when it's hot, they flap their wings to cool the hive down.



It takes about 21 days for a worker bee to grow from an egg into an adult bee. During the time when they collect honey, workers have special legs with baskets for carrying pollen. They also have special glands that make wax and the smell they need for their jobs. Worker bees are smaller than drones or the queen bee. They also have stingers, but if they use them, the stinger stays in the target, and the bee dies.

## SECTION 3: BEEHIVES

### 3.1 Introduction

While bark hives are commonly used in many places, this manual advises against them due to the harm they cause to trees. Instead, we recommend using wooden hives, which offer a more sustainable alternative. To construct your own Top bar hive, refer to the plans and dimensions provided in this manual. It's important to follow these measurements precisely to ensure the components fit together correctly.

### 3.2 Top Bar Hives

Top bar hives are long boxes that hold several slats on top called top bars. Bees build one comb down from each top bar. Top bar hives offer many advantages explained as follows:

1. The construction of top bar hives only requires exact measurements for the top bar itself. Other measurements are less critical, allowing hives to be built with simple tools and inexpensive local materials.
2. The size of the hive can be adjusted to fit local conditions.
3. Each comb is easily accessible without disturbing the others. This reduces disturbances to the colony and minimizes the number of bees flying around when the hive is open.
4. Inspecting the brood is simple, giving beekeepers better control over hive management.
5. Beekeepers can determine the best time to harvest honey without disturbing the brood. This results in high-quality honey, free of pollen and brood.
6. Top bar hives provide good quality beeswax, which has a ready market.
7. No heavy lifting is required apart from the combs, making top bar hives manageable for those who can't lift heavy weights.
8. All top bars are at the same level, customizable to suit individual preferences.
9. If there are predators, hives can be suspended above the ground at a convenient height using wires.
10. Better hive management techniques promoted by top bar hives help protect, preserve, and increase bee populations. This benefits the

economy through increased pollination, honey production, and beeswax harvesting.

### **3.3 How to make top bar hives**

Whenever feasible, opt for top bar hives made from light, well-seasoned, high-quality wood. Avoid wood with a strong odor. Before carefully nailing the hive together, you can use water-resistant glue to secure the parts in place. You can use any wood to make a hive as long as it

- Isn't warped or twisted
- Resists rot from the sun and rain
- Most woods aren't termite-proof, so all hives need protection from termites.

The hive itself has just six parts, with measurements that aren't too strict, so you don't need highly skilled workers for construction.

In the wild, bees build their comb in a downward curve. So, the hive's sides should be angled to match this curve. This helps prevent bees from attaching the comb to the side walls.

The top bars need precise measurements and must be uniform. Each bar should be 33mm wide. This is crucial because tropical honey bees make combs that are 25mm thick. The comb attaches to the center of the bar, leaving a 3.5mm space on each side. When two bars have combs, there's a 7mm gap between them (3.5mm + 3.5mm). This inner space, known as bee space, lets bees move freely on the comb. Two types of beehives are being promoted and these are: Tanzanian Top Bar Hive (TTBH) and Kenyan Top Bar Hive (KTBH).

### **3.4 Advantages of KTBH over TTBH**

1. **Smaller Space:** KTBH has a smaller space, which prevents colonies from overcrowding the hive, making them easier to manage.
2. **Non-Attached Combs:** The bending sides of KTBH prevent combs from attaching to the hive walls.
3. **Moisture Management:** The design of KTBH allows bees to easily fan out moisture, promoting a healthier hive environment.

However, it's worth noting that TTBH is easier to construct compared to KTBH.

Measurement of the Top Bars:

- Length (d): 50cm
- Width (f): Exactly 33mm

- Height (h): 15mm to support heavy combs

The most critical measurement is the width of the top bars, which must be precisely 33mm. If the space is narrower, bees can't pass through and may seal it with propolis. If the space is wider, bees may build combs on it. Therefore, adhering to the 33mm width is essential for proper hive function.

### 3.5 Kenyan top bar hive

#### 3.5.1 Structure

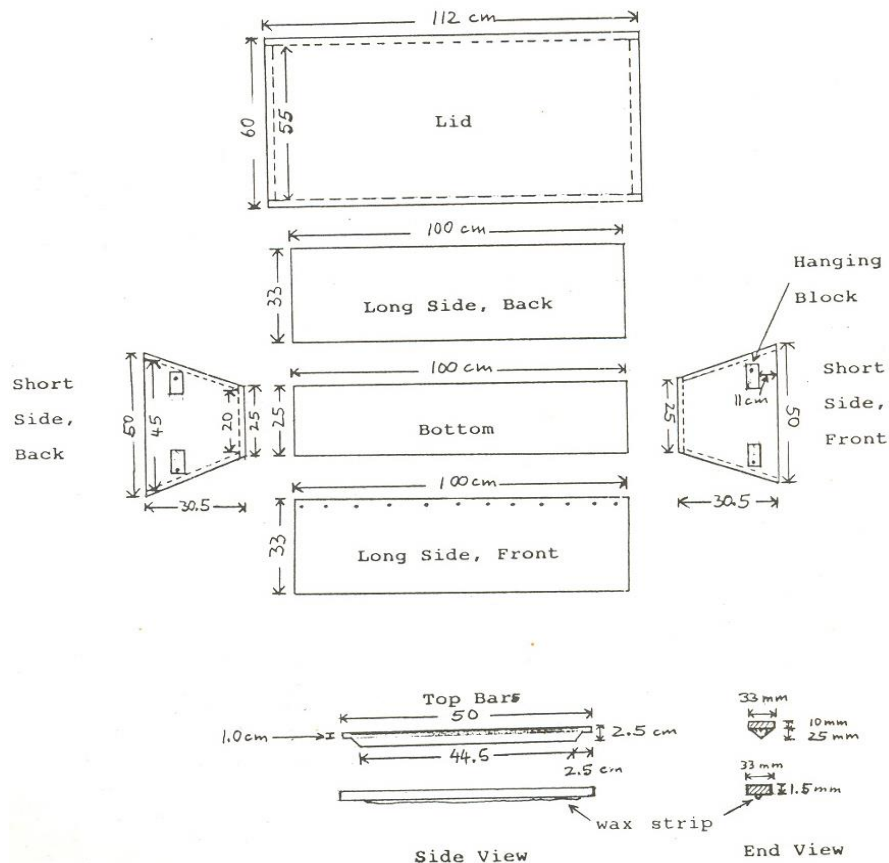


Fig 3.1: Plan of the Kenyan Top bar hive

If you plan to hang hives,

- Create a hanging block to ensure they're balanced securely.
- Top bars should be crafted from high-quality wood with precision to fit snugly into the hive.
- Include a starter strip along the middle of each top bar to give bees a guide for starting their combs.
- For applying wax on the middle of the top bars, expose them, along with clean beeswax, to sunlight, heat, or melt the wax.

### 3.5.2 Lid

The flat lid shields the top bars below and it can be easily fashioned using the provided dimensions and covered with galvanized sheet metal, tar paper, or other waterproof materials. To improve ventilation, lift the lid slightly by placing sticks underneath it on the top bars. If using metal or tar paper for the lid, regulate hive temperature by adding a thick layer of grass on top to shield it from extreme temperatures.

### 3.6 Hive Hanging

Elevate the hive off the ground using a sturdy wooden, rock, brick stand, or live stands. Ensure the stand holds the hive level. Alternatively, you can hang the hive by suspending it from a wire between two trees or from a branch.



Fig 3.2: Occupied Beehive

It's crucial to consider the height when positioning your hive. Ideally, place it between 3 to 5 meters above ground level. This height not only boosts bee activity but also shields the hives from potential threats like fire and vandalism.



Fig 3.3: An apiary

### 3.7 Numbering of hives and apiaries

Each hive will have their unique ID number written on the hive together with the hive number to enable to trace the source of all its honey. In some case an apiary tag will be secured to a tree to identify the apiary.



Fig 3.4: *Numbering is very important for administrative and honey traceability purposes.*

### 3.8 Suspension of the hives

In the beekeeping initiative, all newly constructed hives are to be suspended 3 to 5 meters above the ground level. This elevated positioning is achieved by utilizing pulleys and ropes to hoist them to a significant height. Dedicated mentors should provide guidance and assistance to farmers in properly hanging the hives, ensuring they are securely suspended at the optimal height. This elevated placement not only encourages bee activity but also helps protect the hives from potential hazards such as ground-based predators and adverse weather conditions.



Fig 3.5: Suspended Beehive above 3m

The image above illustrates a hive suspended above 3 meters. Hanging hives at this height offers several advantages. Firstly, it enhances hive occupancy by

attracting more bees. Secondly, it mitigates the risk of attacks from predators like honey badgers and minimizes the threat of fire damage and honey theft. During the harvest season, the hive needs to be lowered using a pulley and rope system. Harvesting requires a team effort involving two or three individuals: a mentor, the lead beekeeping farmer, and the hive owner. This team will be equipped with protective gear including veils, overalls, gloves, and gumboots, along with a smoker to ensure safe and efficient harvesting.

### **3.9 Preparing a new hive for bee occupation**

To encourage bees to occupy a new hive, you can prepare it by applying either Propolis or Beeswax and or a mixture of both on the inside of the hive. Before application, soften the chosen substance(s) by warming them in hot water, near a fire, or in direct sunlight. This process helps make the hive more appealing and acceptable to the bees, encouraging them to establish their colony within it.

### **3.10 Where to set up an apiary**

While bees can thrive in various locations, strategic hive placement is crucial for maximizing honey yields and profitability for beekeepers. African bees, known for their defensive nature, should be kept away from public areas or places where they could potentially sting people. Additionally, bees require access to nectar and pollen sources within their vicinity, ideally within a 2-kilometer radius. Although bees can fly long distances in search of food, shorter distances are more economical for honey production, as they allow for more efficient food collection.

The apiary must have good air circulation to ensure proper airflow, while also being shielded from strong winds that could cause bees to drift. Providing partial shade can protect hives from excessive heat. Access to water within 500 meters is essential for bees, either naturally or through provided containers with landing aids to prevent drowning.

To safeguard hives from ants and termites, it's essential to prevent weeds from growing around the hive, as they can serve as pathways for pests. Additionally, weeding should be done carefully to avoid disturbing the bees. During dry spells, creating a firebreak around the apiary can prevent hives from being damaged by wildfires. Keeping the apiary clean and tidy at all times helps maintain hive health and productivity.

## SECTION 4: MOVING A SWARM OF BEES INTO A NEW HIVE

### 4.1 Capturing a swarm

If bees don't naturally occupy the hive, they may need to be moved into it. Bees readily occupy hives during swarming, a process where they create a new colony.

Bees swarm for various reasons

- Overcrowding before the honey season
- Destruction of the hive or scarcity of food sources/water
- Sudden failure of the queen to lay eggs, hot or poorly ventilated hives, lack of space for egg-laying, or honey storage

Swarms can often be found hanging on trees or under building eaves. Once a swarm is located, it should be promptly captured and transferred to a hive. Brush or shake the bees into a basket, empty calabash, or cardboard box, and then transfer them into the empty new hive.



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

Fig: 4.1: Capturing a Swarm of Bees

### 4.2 Handling a Swarm

Bees in a swarm typically don't sting unless provoked. However, for safe transfer, NEVER brush the bees without using smoke, and always have a veil and smoker ready. After capturing the swarm, gently shake them into the new hive and leave them undisturbed for a few days. Soon, they will settle down and begin storing food and caring for their young.



The best time to transfer bees is during the honey season, also known as the swarming season. This typically occurs immediately after the dry spell following the rainy season (around February to May) and during spring (August to November).

### **4.3 Using Bait Hives**

A well-baited hive can be positioned high in a tree or on a roof. Once the swarm has settled in the hive, the bees will begin to familiarize themselves with its location. Therefore, it's best to place the hive in its final position on the same day the swarm occupies it. If the hive has been occupied for some time, the bees will have already adapted to its location. In such cases, the hive can only be moved over longer distances, and several weeks later, it can be relocated to its desired spot.

Constructing a swarm box can be costly. Alternatively, other materials such as cardboard boxes, baskets, or gourds can be used as effective and affordable alternatives.



*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.*

### **4.4 Inspecting the colony**

The best time to inspect the colony is on a bright, sunny day when the bees are actively working. Avoid disturbing the bees on cold, rainy, or windy days, or during nighttime. When inspecting the colony, do the following:

- Light the smoker and approach the hive from the side to prevent blocking the bees' entrance.
- Apply a bit of smoke to the entrance holes, especially the busiest ones.
- Lift the lid and smoke the surface before placing the lid back, upside down, for a short time.
- Carefully loosen the top bars with a knife, remove them, and examine each one individually.
- Handle the top bars gently, always keeping the combs vertical to prevent breakage.
- Throughout the inspection, be mindful of the queen's whereabouts.
- Return the top bar she may be on as soon as possible, as losing her could be catastrophic for the colony.
- Handle the top bars with care, avoiding crushing any bees.
- After inspecting each top bar, apply smoke as needed to calm the bees.
- Once the inspection is complete, return all hive parts to their original positions in the same order they were removed to maintain the structure of the brood nest. Movable top bars make checking combs easier, as each can be lifted and turned around.
- During the inspection, remove any pests or insects found in the hive.

## 4.5 How to make more money from a colony

As a beekeeping, it's essential to explore various methods to increase honey production with the hives. Through experience, we can discover numerous strategies for success and they are explained below as follows:

### 4.5.1 Proper Hive Placement



Fig 4.3: Protect the hives from strong winds and sun!

Position the hives in areas protected from strong winds and heavy rains by trees in order to minimize exposure to adverse weather conditions. Always ensure your Beehives are situated near abundant sources (Bee trees) of nectar, pollen, and water such as Musangu, Munga-utuba, Mungobe, and Chimphakasa. Others Bee trees include Magodi and Lukusuzi, Musamba and Kamphoni, although these are commonly found in plateau areas.

Water availability is another important requirement to put in mind when placing Beehives. Always ensure that water is readily available within 500 meters from the apiary. If water sources are limited, consider providing a shallow water container with sticks for bees to land on and take off, preventing them from drowning.

#### 4.5.2 Colony Inspection

Regular inspections of colonies are vital, ideally performed monthly. Why? Ensuring a fruitful harvest requires diligent care of the beehive field, necessitating regular progress checks. During these inspections, evaluate the honey and pollen supply, population size, and the condition of the queen and brood. To aid our producer groups, utilize a data form (as depicted below) for recording hive progress. Avoid inspecting hives during cold or rainy weather to minimize disturbances to the colony.

#### Honey flow form

This form can help the honey farmer to keep records for management of the apiary.

Unit/ Place: \_\_\_\_\_ Group Name: \_\_\_\_\_

Chiefdom: \_\_\_\_\_ Recorder: \_\_\_\_\_

DATE	HIVE TYPE #	LOCATION (GPS Points)	QUANTITY	COMMENTS

Inspect the apiary location every fifteen (15) days to monitor colony health and identify environmental issues requiring apiary relocation. Utilize a form to document all monitoring and corrective actions throughout the year, associated with apiary procedures, activities, or equipment.

A common issue in apiaries is low hive occupancy or unoccupied hives. Re-bait hives every two (2) weeks during March to May and August to October, and monthly during other months. Other problems may include honey theft, poor hive maintenance, vandalism, honey badger attacks, ant infestations, beekeeper negligence, and pest infestations such as rodents. Mentors must identify these issues and implement corrective actions, recording all actions taken.

#### **4.6 Basic management**

Once the hive is occupied and the bees are active, it's important to adhere to the following simple basics.

- Avoid standing in the flight path of the bees.
- Work quietly without excessive talking or drumming noises.
- Work efficiently but smoothly.
- Carefully remove the lid and puff smoke gently around the entrance of the hive.
- Create a gap at one end of the hive by removing a few empty bars, being careful not to disturb the bees. Then, remove one bar at a time.
- Smoke the gap gently and hold the bar vertically to avoid breaking the comb.
- Keep the bars in the same order and avoid squashing any bees when replacing them in the hive. Squashed bees release an alarm pheromone that can agitate other bees.
- Avoid visiting the hive during the warmest part of the day but early evening, around six o'clock or very early in the morning is preferable.

- Work with only a few hives at a time, ideally for no more than 45 minutes in an apiary. Bees from the first hive worked on may become agitated and provoke further disturbance among all the bees.
- Wear light-colored clothing, preferably with protective gear such as a veil to shield the eyes and face.
- Ensure the top bars are pushed together as they are replaced to eliminate any gaps.
- Finally, gently replace the lid on the hive.
- Maintain a tidy area around the hive by keeping the grass cut and the surroundings clean.

## **SECTION 5: HONEY CROPPING**

### **5.1 Introduction**

Honey cropping, a fundamental aspect of beekeeping, entails the meticulous process of harvesting honey from beehives. It requires precise timing, appropriate equipment, and a deep understanding of bee behavior and hive dynamics. Honey, esteemed for its delightful flavor and diverse applications, holds significant cultural, nutritional, and economic value worldwide, emphasizing the importance of honey cropping for beekeepers and consumers alike.

The honey cropping process begins with assessing the hive's readiness for harvesting, considering factors like hive population and environmental conditions. Beekeepers employ various methods and equipment to extract honey while minimizing disturbance to the colony. Traditional techniques involve smoke to calm the bees and careful frame removal, while modern methods offer efficiency and hive preservation.

After extraction, honey undergoes filtration for purity and quality. Beekeepers may then bottle it for consumption or further processing. Honey cropping not only provides a delicious natural sweetener but also supports bee health and sustainability. Responsible practices ensure hive welfare and environmental balance, fostering a continuous supply of this precious liquid gold.

### **5.2 Cropping seasons**

In Zambia, honey harvesting typically occurs during two main seasons: April, May, and June, as well as October, November and December.

### **5.3 Cropping of honey from top bar hives**

A skilled beekeeper understands the importance of proper honey cropping to avoid waste. Quality honey begins with harvesting and can fetch a high price in the commercial market.

- To ensure quality, beekeepers must use plastic containers, smokers, smoking materials, knives, and protective clothing (veils, overalls, boots, and socks).
- Before starting the harvesting process, it's crucial to inspect the hive. Only fully or half-sealed combs should be harvested.

- Whenever possible, select combs sealed with wax, as they ferment less quickly and are fully ripened without excess water content.
- During harvesting, handle the combs vertically to prevent breakage. Cut the entire comb, leaving a 1 cm strip to serve as an orientation line for the bees when constructing new combs.
- As you harvest the combs, remove the propolis from the sides of the top bars before replacing them. Propolis is essential for future hive baiting and should be stored safely.
- Continue harvesting ripe honey until you encounter a large portion of pollen. Remove this portion and place it in a separate container. This indicates proximity to the brood nest. Avoid harvesting brood combs, even if they contain honey, as it can affect the hive's labor force.
- Avoid overcropping to prevent swarming. Leave at least 8 combs as food for the bees during nectarless seasons.
- Place combs with unripe honey immediately behind the last brood or pollen comb, followed by the harvested top bars. This facilitates the queen's movement and comb building in the central part of the hive.

#### 5.4 Cropping from the log hive

When harvesting from a log hive, it's essential to smoke the brood and honey door first. After smoking the hive, open the honey door and continue smoking to prevent bees from causing disturbances.

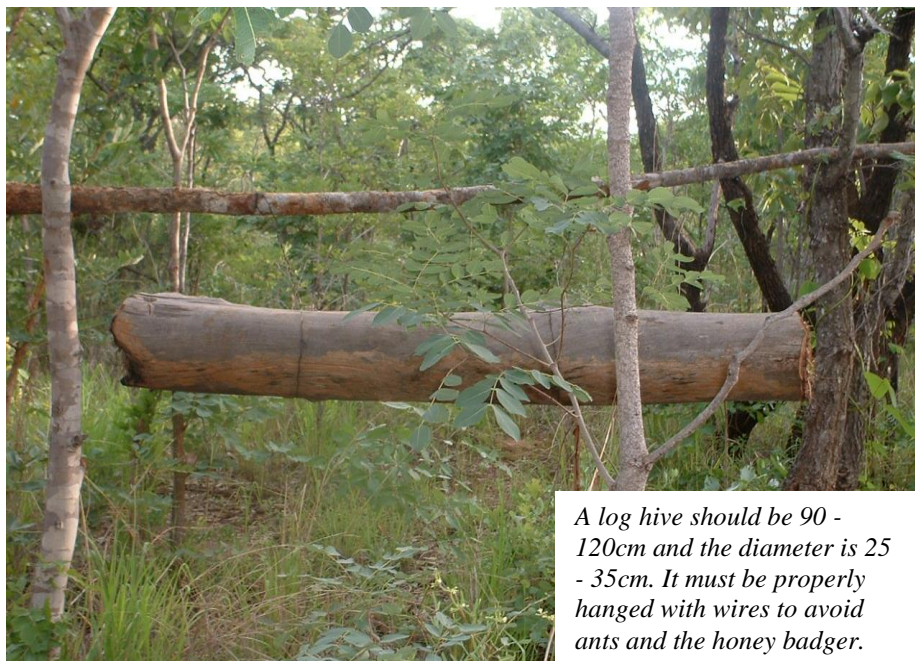


Fig 5.1: log hive

The combs in the log hive may lie either vertically, horizontally, or both. Carefully remove the combs and brush off any bees before placing them in a clean container. If you encounter brood during harvesting, it's crucial to refrain from harvesting further, as the brood represents the future labor force of the hive and should not be disturbed.

## **5.5 Grading**

- Right after harvesting, it's crucial to grade your comb honey to prevent any damage to the combs while they are still in the cropping container.
- Select the combs that are light in color and mostly sealed with honey. Remove any bees and debris, and place these combs into the first-grade container.
- Separate the very dark combs and those with plenty of pollen cells or unsealed honey into a separate container. These are considered second-grade honey combs.
- Ensure they are also cleaned well. This grade tends to ferment quickly and is typically sold in the local market. Seal the container with the first-grade honey tightly to maintain its quality.

## **5.6 Distinguishing High Grade from Low Grade Comb Honey**

The difference between high-grade and low-grade comb honey is readily noticeable upon observation. Low-grade honey tends to be darker in color, often containing visible pollen and having a thicker consistency. In contrast, high-grade honey typically appears white or light in color, with most cells sealed with honey.

To ensure the quality of honey, it's essential to separate the high and low grades during cropping to prevent breakage in the cropping container. Avoid smoking the honey after cropping to prevent contamination. Take care to protect the honey from exposure to water, rain, sun, heat, or other environmental factors. Remove any impurities such as dead bees, grass, or foreign materials. Additionally, refrain from cropping during rainy weather, as honey can absorb moisture from the air, causing it to become watery.



## SECTION 6: PROCESSING AND EXTRACTION OF HONEY AND WAX

### 6.1 Processing Comb Honey

Comb honey can be efficiently processed using a honey presser, which offers a cost-effective and less wasteful alternative to traditional methods. Here's the process for extracting honey from combs:

**STEP 1:** Place wire gauze at the bottom of the honey press basin and layer a generous amount of comb honey on top, covering it with another layer of wire gauze. The first wire gauze acts as a strainer to allow only liquid honey to pass through, while the top layer prevents the clamp from sticking.

**STEP 2:** Rotate the pressing clamp clockwise to press out the honey until it stops dripping.

**STEP 3:** Add a fresh batch of comb honey to the basin and repeat the pressing process as needed, typically 2 or 3 times, until all the honey is extracted. Remove the pressed combs containing wax by scraping them off the wire gauze with a knife and place them in a container.



*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.*

Fig. 6.1: Honey pressing

**STEP 4:** Strain the honey through a clean white cloth stretched over a clean container. Although this process may be slow, it ensures the extraction of high-quality, clean honey.

**STEP 5: Bottling and Packaging** - The extracted honey is now ready to be bottled for consumption. Ensure that the extraction room is clean, and workers adhere to sanitary and hygiene standards.

It's important to note that second-grade honey cannot be stored for an extended period as it tends to ferment quickly, whereas first-grade honey can be stored longer

## **6.2 Processing Wax**

In order to process Wax, follow the following simple basics:

- Do not discard unused combs as they can be repurposed into wax.
- Begin by soaking the combs in water for several hours or overnight to remove sugar residues and prepare them for wax extraction.
- Next, transfer the water-soaked combs to a non-copper or non-aluminum pot placed over a fire.
- Heating the mixture will facilitate the separation of wax from other components.
- Carefully stir the mixture until it forms a thick consistency resembling porridge, taking care not to let it boil and risk burning the wax layer on top.
- Afterward, strain the mixture through a sack or mesh wire to remove impurities, then allow it to cool in a shaded area or overnight.
- As it cools, the wax will solidify on the surface and can be easily collected.
- Applying a thin layer of honey water, soap, or oil to the container beforehand can aid in the removal of the wax.

For commercial use, the extracted wax can undergo further processing, such as filtering through cotton cloth.

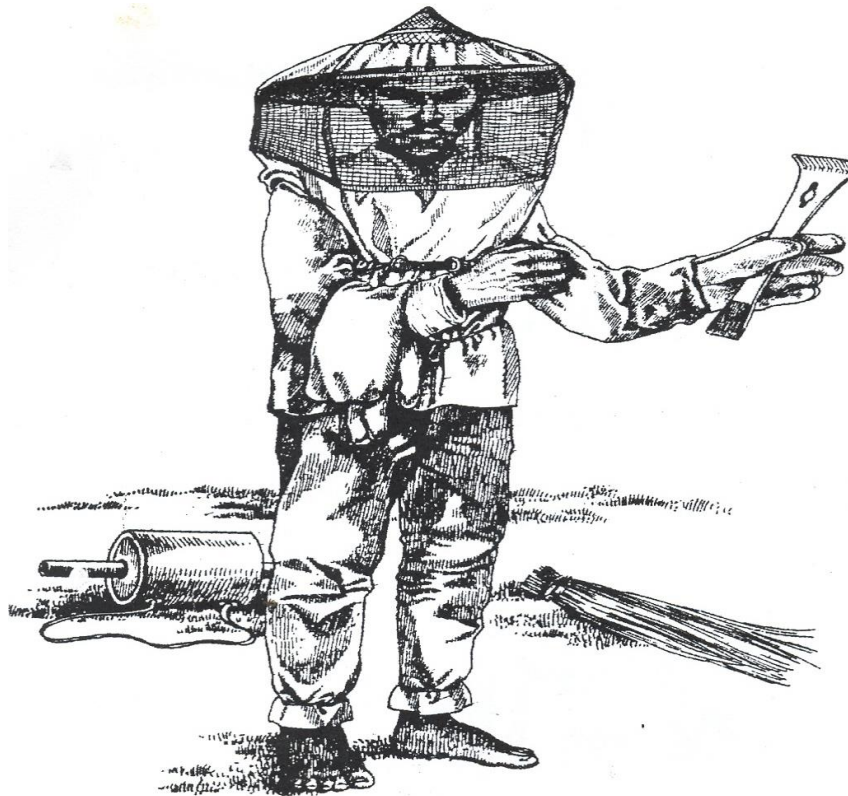
Wax has a lot of uses which include the following:

- Crafting lotions
- Producing candles
- Attracting bees to hives
- Cosmetic applications
- Manufacturing polish

## SECTION 7: A BASIC GUIDE TO BEEKEEPING EQUIPMENTS AND TERMINOLOGY

### 7.1 Beekeeping equipment

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



*Protective clothing for beekeeping, i.e. veil, hive tool, bee brush, smoker, overall, & gloves.*

Fig 6.1: Necessary Beekeeping equipment

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.

## 7.2 Beekeeping Terminology

There are various terminologies that are used in the Beekeeping practice. Here is a list and brief explanation of each one of them.

- **Apiary:** A designated location housing one or more bee colonies.
- **Beemilk (Royal Jelly):** A specialized secretion rich in protein produced by young bees (nurse bees) and fed to young larvae, queen larvae, and the queen herself.
- **Beeswax:** Material secreted by special glands of young bees used in constructing honeycomb.
- **Brood Comb:** Honeycomb containing cells primarily filled with brood (eggs, larvae, and pupae).
- **Brood:** Term encompassing eggs, larvae, and pupae.
- **Capped Brood:** Cells sealed with a thin layer of wax and pollen where mature larvae transform into pupae.
- **Cells:** Hexagonal compartments on honeycomb used for storing brood, pollen, or honey.
- **Bee Colony:** A complete biological unit typically consisting of one queen, thousands of worker bees, a few drones, and combs housing honey, pollen, and/or brood.
- **Comb:** A sheet of wax with cells on both sides used for brood rearing, honey storage, and pollen storage.
- **Drones:** Male bees that develop from unfertilized eggs.
- **Drone Brood:** Eggs, larvae, and pupae of drones.
- **Foraging:** The process of collecting pollen, nectar, and water by bees.

- **Hive:** A man-made shelter for bees.
- **Honey:** Sweet liquid derived from flower nectar, partially digested by worker bees and stored in honeycomb cells.
- **Honeycomb:** Honeycomb containing only honey.
- **Honey Stomach:** Front part of a bee's stomach used for transporting nectar and processing it into honey.
- **House Bees:** Young bees in the colony not yet engaged in foraging.
- **Larva:** The immature stage of development in the life cycle of bees, resembling a fat, curled worm.
- **Mating Flight:** A flight taken by the queen bee for mating.
- **Nectar:** Sweet fluid produced by flowers to attract pollinators.
- **Orientation Flight:** Flight taken by worker bees and queens to familiarize themselves with surrounding landmarks.
- **Pollen:** Nutrient-rich powder produced by flowers, essential for brood rearing and adult bee nutrition.
- **Pollination:** Transfer of pollen from male to female flower parts, crucial for fruit and seed development.
- **Propolis:** Resinous material collected by bees from plant sources, used for sealing cracks and reducing hive entrance size.
- **Prime Swarm:** The first swarm to leave a crowded colony, usually accompanied by the old queen.
- **Pupa:** Intermediate stage between larva and mature insect development.
- **Queen:** Female Bee responsible for laying fertilized eggs and leading the colony.
- **Queen Cell:** Large, peanut-shaped cell in which a queen larva develops.
- **Sealed Honey:** Honey thickened and capped with wax by bees.
- **Worker Bee:** Sterile female Bee responsible for various tasks within the colony, including foraging, nursing, and hive maintenance.

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