

Apiculture Production **MANUAL**



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Apiculture Production Manual

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Foreword

This manual was produced as a training tool to promote beekeeping as an alternative livelihood under the Strengthening Climate Resilience of Agricultural Livelihoods in Agro-Ecological Regions I and II in Zambia (SCRALA) project. The SCRALA project supports the Government of Zambia to strengthen the capacity of farmers to plan for climate risks that threaten to derail development gains, promote climate resilient agricultural production and diversification practices to improve food security and income generation, improve access to markets, and foster the commercialization of climate-resilient agricultural commodities. The project is financed by the Green Climate Fund (GCF) and implemented by the Zambian Ministry of Agriculture with support from the United Nations Development Programme (UNDP), the SCRALA project seeks to support the Government of Zambia in building climate-resilient food security and poverty reduction measures for approximately 940,000 people.

The project runs from 2019 to 2025 and its being implemented across 5 provinces in 16 districts namely Sesheke, Sioma, Senanga, Mulobezi, Kazungula, Namwala, Gwembe, Siavonga, Chirundu, Chongwe, Rufunsa, Luangwa, Nyimba, Mambwe, Chama and Mafinga.





Table of contents

1.0.	What to know before beginning your Apiculture journey	6
1.1	Composition of the bee colony	6
1.2	What are the main Apiculture products?	8
1.3	What are the benefits of Apiculture?	9
2	2.0 Basic Apiculture requirements	10
	What equipment are needed to practice Apiculture?	10
2.1	Apiculture equipment	10
2.2	Types of beehives	12
	■ Traditional hives	12
	■ Modern hives	13
2.3	Hive Stands	16
	■ Brick stands	16
	■ Hanging by use of wires	16
	■ Pole stands	17
3	3.0 Ideal apiary site	18
	What is the best site for placing your beehives?	18
3.1	Apiary site requirements	18
3.2	Bee flowering plants in Zambia	20
4	4.0 Beehive occupation	22
	How to bring/attract bees into your hives?	22
4.1	Baiting	22
4.2	Swarm or colony capture	23
	■ Colony capture from a tree or ground	23
	■ Swarm capture for bees hanging from trees	24
	■ Capturing bees using swarm boxes	24
5	5.0 Bee and apiary management	26
	How to manage bees and the apiary?	26
5.1	Management Calendar	26



Table of contents

5.2	Pests	28
5.3	Diseases	32
5.4	Bee poisoning from chemicals	35
6	6.0 Harvesting and processing	36
	How to harvest combs and process honey and beeswax?	36
6.1	Harvesting of honeycombs	36
6.2	Honey processing	37
6.3	Processing of beeswax	40
7	7.0 Honey quality	41
	What and where to access honey quality tests?	41
8	8.0. Market access	43
	How to access good markets?	43
8.1	What is marketing?	43
8.2	Aggregating bee products – marketing as a group	44
8.3	Forming an Apiculture group	45
	9.0 References	49

Chapter 1: **Introduction to Apiculture**

1.0. What to know before beginning your Apiculture journey

1.1 Composition of the bee colony

A healthy bee colony always has a **queen**, **worker bees**, **drones** and the **brood** at different stages (egg, larvae and pupae) of development. Each of the members of the bee colony have a special duty and are vital for bee population survival.

The Queen bee

The queen bee has a long abdomen and is brown or light brown in colour, sometimes clearly cross-striped. It has short wings. Her main job is to lay eggs. When in good health, she can lay 2,000-3,000 eggs per day. She has a life span of between 3-5 years.



Figure 1. The Queen bee. (Source: Adobe Stock, <https://stock.adobe.com/au/search?k=queen%20bee>)

The Worker bees

Worker bees are underdeveloped females, and they do not lay eggs. They are smaller than the queen and the drone bees. Their life span is very short, between 7-8 weeks. If you are stung by bees, you should be certain that you have been stung by worker bees. Worker bees have stings and die after stinging.



Figure 2. Worker bee. (Source: Adobe Stock, <https://stock.adobe.com/au/search?k=queen%20bee>)

The duties of worker bees are numerous and these include:

- Guarding and defending the colony from enemies. In an event of enemies, worker bees communicate through the exchange of different chemical signals called pheromones.
- Collecting nectar for honey production, pollen which is protein rich food for bees, and propolis a black resin which they use to seal beehive spaces. Bees communicate by various vibrations and dances when informing other worker bees in the hive about the direction and distance to nectar and pollen sources.
- Converting nectar to honey.
- Feeding the queen bee and larvae.
- Making beeswax and building combs.
- Maintaining the temperature inside the hive at 35°C by fanning their wings.

Collection and conversion of nectar to honey

Worker bees collect nectar and pollen from flowers for food. They are attracted to flowers by colours and scents. They collect nectar and pollen in a radius of about 2-3 km from their hive. Worker bees convert nectar into ripe honey by drinking nectar which is acted on by enzymes in the worker bees' gut and regurgitate it into honeycomb cells. They then reduce the water content and seal ripe honey in the honeycomb cells with a thin layer of wax. Ripe honey can stay in the cell for a long time (over many years) without going bad. Honey is essentially bee food which is produced in large quantities. It is this excess honey that we humans harvest for our needs.

Collection and use of pollen

Pollen is collected from flowers by the bee's hairs. Pollen contains proteins, vitamins, mineral salts and fats and is used to make bee milk by worker bees. Bee milk is food for the growing bee larvae. Through collection of pollen, bees perform a vital function of plant pollination.

Collection and use of water

Worker bees collect water for cooling the hive. Water is also used in the digestion of food. It is also an important part of the bee milk (larval food).

The Drones

Drones are male bees. They are bigger than worker bees but smaller than the queen bee. They have large dark eyes. They have no stings. Their only responsibility is to mate with the queen, and they die after mating due to the violent rip off of the penis and abdominal tissues. Their life span is about 60 days.



Figure 3. The drone bee. (Source: Adobe Stock, <https://stock.adobe.com/au/search?k=queen%20bee>)

The Brood

The brood includes the bee eggs, larvae and pupae for all bee members. The brood is always situated in the middle of the colony for warmth and safety. Darker brood comb indicates that they are older than light coloured ones. Temperature around the brood is normally maintained at 35 °C. When temperature drops, worker bees often cluster together to generate heat; and when too hot, they disperse and using their wings fan air from outside into the hive.

1.2 What are the main Apiculture products?

Apiculture is a practice of keeping bees for honey, beeswax production and in some cases, propolis. Apiculture is a livelihood option which when managed well is a good income earner.

Honey, beeswax and propolis are the main products of Apiculture.

Honey

Honey is a sweet delicious and nutritious liquid which is used in place of sugar as a sweetener, in tea, porridge, on bread as a spread, in baking, confectionery and in

brewing. Honey sugars are easily digestible and are healthier food than the refined cane sugars. Honey is used as medicine alone or in combination with other substances. It has been used to treat coughs, colds, asthma, constipation, stomach ulcers among others. It is a tonic food.

Beeswax

Beeswax is a valuable bee product processed from honeycombs. It is used in cosmetics, medicines, polishes and candles.

Propolis

Propolis is a resin-like material made by bees from plant buds. propolis has some antibacterial and antibiotic properties with high demand for use in the pharmaceutical industries and dental application. The sale of propolis could be feasible in Apiculture groups where it can be bulked up since it is harvested in very small quantities.

1.3 What are the benefits of Apiculture?

- Income - Honey and beeswax are a good source of income if well managed and marketed.
- Employment - Apiculture creates employment
- Pollination service - Bees play an important role in the pollination of flowering plants, (trees, shrubs, herbs and agricultural crops). Without bees plant production could be jeopardized and the fate of humanity could be at risk.
- Forest conservation - Apiculture is used as an important conservation activity. Beekeepers know the value of conserving trees for honey production.
- Low labour and land demands - Apiculture offers minimal competition for labour and land. Peak labour demand in Apiculture (harvesting) occurs outside the busiest farming periods/seasons.
- Livelihood diversification - Apiculture enterprise diversifies farmer livelihoods.



Chapter 2

2.0 Basic Apiculture requirements

What equipment are needed to practice Apiculture?

2.1 Apiculture equipment

The following basic Apiculture requirements, equipment and tools are essential for a beekeeper.

Beehives – beehives are homes for the bees. This is the most important investment as it affects honey production. There are different types of beehives, each with its own advantages and disadvantages.

Bee veil – Protects beekeeper's face from bee stings during beehive inspection, apiary management and honeycomb harvesting.

Gloves – Protects beekeeper's hands from bee stings.

Gumboots or shoes – Gumboots protects the feet from bee stings.

Helmet/hat – Helmet or hat protects the head from bee stings.

Soft brush - Used to brush off bees from honeycombs during harvesting.

Smoker - To produce smoke necessary for calming bees when carrying out any Apiculture management activity. The best material for smoke production is dry cow dung. Pine twigs can also be used.

Queen Excluder – This is a device that restricts the queen from escaping the hive or swarm box. It is normally put at the entrance of the hive to ensure that the queen doesn't escape. Paper or money clips with an inner measurement of 4 mm can be used as alternative queen excluders.

Knife – A knife is used to separate top bars during inspection and to cut honey combs during colony capture and honey harvesting.

Queen cage or match box – To cage the queen bee during colony or swarm capture.

Containers – Clean plastic buckets that have tightly fitting lids are required to put the honey combs or frames into immediately they are harvested from the hive.

Honey processing equipment – A press honey extractor extracts honey from combs by means of pressure through pressing. A centrifugal honey extractor extracts honey from

honeycombs by means of rotating the combs at a high centrifugal speed. Honey combs attached to the frames are normally used when extracting honey using the centrifugal extractor.



Figure 4. A bee veil (Tom Grady Rural Merchandise)



Figure 5. A smoker, knife and a bee brush (Source: Forest Department (Date Unknown))



Figure 6. Centrifugal manual honey extractor and a press honey extractor (Source: Forest Department, Date Unknown)

2.2 Types of beehives

A hive is a home or shelter for bees. This is where bees live and make honey from.

■ Traditional hives

Honeycombs in traditional hives are normally fixed to the walls of the hives and this offers no flexibility during inspections and harvesting. Once the comb is removed from the hive it cannot be returned. The most common type of traditional hives is the bark hives. Logs with a hollow on the middle have also been used.



Figure 7. Bark hive

Merit of traditional hives

- They are made from locally available material, hence cheap to acquire.

Downsides of traditional hives

- They are not durable.
- Use of traditional bark hives contributes to deforestation.
- Honey harvested from traditional hives requires careful and rigorous grading to have clean pure honey combs.
- Honey and brood combs are always attached to the walls of the hives making it impossible to replace the combs once removed from the hive.

■ Modern hives

Modern hives are different from traditional hives in that they have moveable combs attached to top bars or frames. Bees when well guided would build one comb from each top bar or frame. To do this, top bars should be made to the right dimensions (see top bar dimensions below). Common modern hives in Zambia are Kenyan and Tanzanian top bar hive. Very few beekeepers have the most productive Langstroth frame hives.

Kenyan Top Bar Hive

Below are standard Dimensions of a Kenyan top bar hive

Length.....60-100 cm

Width top.....45 cm

Width bottom..... 20 cm

Height.....30.5 cm

Top bar.....50*3.3*2.5 cm



Figure 8. Kenyan top bar hive (Zamutwa)

Tanzania Top Bar Hive

Below are standard Dimensions of a Tanzanian top bar hive

Length.....100 cm

Width.....45 cm

Height.....30 cm



Figure 9. Tanzanian Top Bar Hive (Source: Pinterest)

Langstroth hive

The Langstroth hive is a commercial beehive made up of a brood chamber, queen excluder and honey supers with 9 or 10 frames. The queen excluder excludes the queen from laying eggs in the super (s) enabling beekeepers to have only pure honey in the honey supers. The queen is normally confined only to the brood chamber.



Figure 10. Langstroth hive (Wikipedia)

Standard dimensions of top bars for modern hives

Length of the top bar should be long enough to fit on the hive.

Width of the top bar should be exactly 33 mm (3.3 cm). This width gives bees their natural spacing to build one comb to each separate top bar.

Thickness of the top bars should be at least 2.5 cm to support heavy combs.

Advantages of Modern top bar hives

- Easy to conduct inspections as top bars with honeycombs can be moved back and forth.
- It's easy to inspect and judge the right time when honey combs are ready for harvesting. This enables the beekeeper to harvest only ripe honey combs without disturbing the unripe combs and the brood.
- The small entrance holes made in modern top bar hives help keep out some of the pests.

Disadvantages of Modern hives

- Modern hives are normally costly compared to traditional hives.
- Bees sometimes attach combs to the sides of the hives and sometimes across the top bar hives even with proper baiting. This situation may bring problems associated with fixed comb hives (traditional hives). However, this situation is more prevalent if there are no starter strips or foundations or a well baited glove with clean bees wax from which bees should start building combs.
- Occupation rate is generally low in modern top bar hives compared to bark hives that are normally placed or hanged high in trees.

2.3 Hive Stands

There are different ways in which hives can be placed in the apiary. Each method of placing hives has its own unique advantages and disadvantages depending on the pests common in your area.

■ Brick stands

This hive stand is useful in areas with a lot of red ants. However it doesn't control honey badgers.

■ Hanging by use of wires

This is the best way of placing hives. It helps in controlling both red ants and honey badger as long the hive is placed at least 1.5 m above the ground.



Figure 11. Kenyan top bar hive hanging by wires

■ Pole stands

The hive is placed in a platform of wood that is supported by poles. A empty 2lt cooldrink bottle's bottom could be used to prevent ants from reaching the hive.



Figure 12. Kenyan top bar hive on pole stand



Chapter 3

3.0 Ideal apiary site

What is the best site for placing your beehives?

3.1 Apiary site requirements

An apiary is a place where honeybees are kept in hives. The best site for placing your beehives should have the following:

Bee plants. Ensure that there are enough nectar producing plants around the apiary. The closer the nectar plants to the apiary the better, even if bees can fly within a radius of 2 km for food and water. When trees are few, plant flowers around the apiary to supplement the naturally growing bee plants.

Distance away from working people. The apiary should be at least 100 m away from homesteads or working people. This is to avoid disturbances and unnecessary bee attacks.

Water. Bees need water to cool the hive especially when it's hot. Ensure that there is a water source in the vicinity (at least within a radius of 500 m from the apiary) so that bees do not disturb people at the water sources.

Wind breaks. The apiary should have enough windbreaks to help bees fly into the hive smoothly when it's too windy. It is advisable to have some bushy vegetation between hives and in front of the entrance holes to help prevent bees from unhindered dashing around if made aggressive.

Shade. Colonies should be placed or hanged under the shade all the time. Under the shade, the temperature in the hive is easily maintained at the required temperature.

Protection of colonies. The beehives should be protected from wondering animals.

A barbed wire fence or nay type of fence around the apiary is ideal.



Figure 13. Kenyan top bar hive in an apiary in Miombo forest



Figure 14. Kenya top bar hive next to homestead

3.2 Bee flowering plants in Zambia

Honeybees collect nectar and pollen from flowering plants. However, they prefer and visit some species for nectar and pollen more than others. Not all flowering plants are excellent bee plants. To learn your area's most common bee plants use the following simple observations: 1. Which species are frequented by honeybees? And 2. Which time of the year do they flower?

Zambia has two honey seasons influenced by the *Brachystegia* and *Julbernardia* species. These two species dominate the miombo woodland which covers a large part of Zambia.

The **main honey season** is the **October-November** harvesting period. This honey season is influenced by the *Brachystegia* species which starts to flower in August and September.

Local names of <i>Brachystegia</i> species	When they flower
Chifuku, Musumbu, Mukuti, Msumbu, Mvunkwe, Mputi, Mbata, Mtumbila, Mtuwa, Lukwe, Towe, Twitwi (Nyanja names)	August and September and extending into October/November
Musompa, Muputu, Musaka (Bemba names),	
Muombo (Bemba, Nyanja and Tonga name)	
Ngalati (Bemba and Tonga name)	

The other honey season is in **May** and **June**. This is influenced by *Julbernardia* species.

Local names of <i>Julbernardia</i> species	When they flower
Mutondo (Bemba, Lunda, Tonga and Kaonde name)	February to May
Muchesa, Mpasa (Bemba names)	
Kabunga (Nyanja name)	
Mwanza, Katondomumba (Lozi names)	
Mumba, Sandwe (Tonga names)	
Kamponi (Nyanja and Tonga name),	
Mwanda (Lunda name).	

The ***Brachystegias*** and ***Julbernardias*** are heavy nectar producers. These important species have to be conserved to maximize honey production. Unfortunately, these two species make good charcoal hence highly sought by charcoal producers.

Tree species which flower outside the above two flowering seasons are also very important. They enable bee colonies to keep up their store of pollen and honey. Some important tree species which flower outside the above discussed flowering seasons includes:

Scientific name	Local names	When they flower
<i>Marquesia macroura</i>	Museshi (Bemba name), Musanya (Kaonde), Mufuka (Lunda)	June to October
<i>Cryptosepalum exfoliatum pseudotaxus</i>	Mulenda, Musambangalati (Bemba names), Mukwechi (Kaonde name), Mukwe (Lozi name), Mukungu (Lunda name).	July to September
<i>Syzygium</i> species	Chibumbya, Luamba, Mufinsa, Mukute and Mushingi (Bemba names), Musombo (Kaonde and Lunda name), Mutoya, Musompe (Lozi names), Katope, Katubwi, Mchisu, Mfowo, Msombo, Mwenye and Nyowe (Nyanja names), Katope (Tonga name)	July to November
<i>Parinari curatellifolia</i>	Mupundu (Bemba and Kaonde name), Mubula (Lozi name), Mpundu (Nyanja name).	July and October

These trees which flower outside the two flowering seasons allow bees to build up their numbers with early rapid breeding so that colonies are at peak strength when the main flowering season starts.

Agricultural crops, fruit trees and other exotic trees also greatly improve honey production. Valuable agricultural crops include beans, sunflower, pumpkins, sweet potatoes, cabbage, rape, sorghum, millet, maize to mention just a few. Good exotic trees for bees to plant around the apiary may include mangoes, guava, orange, lemon, Eucalyptus, pine and Jacaranda.

A bee farmer should always make sure that the apiary or area surrounding the apiary has many of the above-discussed bee plants. Planting ornamental flowers around the apiary would also greatly increase bee food. Remember that the above discussed flowering plants are not the only bee plants.

Chapter 4

4.0 Beehive occupation

How to bring/attract bees into your hives?

4.1 Baiting

In order to attract bees into the hive, top bars and the walls of the hive have to be baited with beeswax. Top bars must be baited with some starter or foundation strip of clean wax. With proper baiting, bees may start building combs from starter or foundation strips.

A top bar being baited with a starter strip and a second one with a V shaped ridge which can be coated with molten wax.

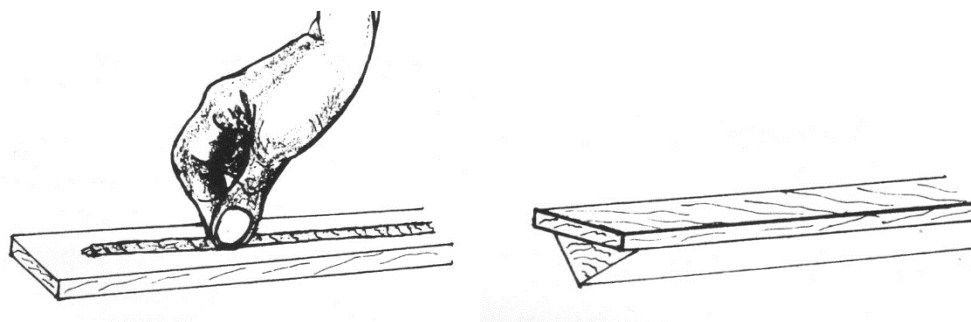


Figure 15. Top bar baited with a starter strip and V shaped ridge. (Source:Bernhard and Renate Clauss)

How to bait starter strips

Melt beeswax on fire in a pot or tin and pour it on the top bar as in (a) or smear as in (b) above and leave it to solidify. Once it has solidified expose the wax to the sun for about 10 minutes. After 10 minutes you can now put the baited top bars in the hive. Without starter strips, bees are more likely to build combs across the top bars. Pouring beeswax in the starter strips or smearing on the glove increases the chances of bees to build combs on the designated middle of the top bar.

To further increase the chances of bees occupying the hive, the inside of the hive has to be lightly smeared with molten beeswax. If hives are not occupied for a long time

after baiting, it is advisable to clean and re-bait the hives before the next swarming season. This increases the rate of occupation.

4.2 Swarm or colony capture

Bee occupation in modern top bar hives is generally lower than in traditional hives. Therefore, bees sometimes may have to be captured and introduced into modern hives if not occupied by baiting. Capture and introduce bees during the honey seasons when food is plentiful, otherwise they may abscond or abandon the hive.

When capturing bee swarms, always have a smoker, catch box or sac, enough smoking material, knife, feather/bee brush, a bucket with a lid, protective clothing, queen cage, queen excluder (in the absence of a queen excluder you can use money or paper clips), spade, axe and hoe/shovel.

■ Colony capture from a tree or ground

- **Step One:** make a fire to prepare the smoking material. Fill the smoker with burning charcoal and the smoking material.
- **Step two:** put on the protective clothing and smoke your clothing and have all the required tools ready.
- **Step three:** smoke the colony thoroughly to disturb bee communication. This helps capture the bees smoothly.
- **Step four:** You dig if the bees are in the ground or chop or cut the tree if they are in the tree trunk near the entrance hole to access combs. Place brood combs and honeycombs separately in boxes. Place the box with the brood combs near the original nest and flying bees will fly into this box and start covering the brood.
- **Step five:** Smoke the bees in the box and search for the queen and when found, capture and put her in the queen cage or matchbox. Searching and capturing of the queen requires special skill and is time consuming. Seal the catch box and take the bees to the apiary for hiving. In the absence of the queen cage you simply brush the bees into the hive with queen excluders on the entrance holes. Money or paper clips with an inner measurement of 4 mm can be used as queen excluders.

- **Step six:** Hiving the swarm. Tie the queen cage on the middle top bar. Place the queen excluders or money or paper clips on the entrance holes of the hive. Release the queen after two weeks. Remove the queen excluder or money or paper clip after a week.
- **Swarm capture for bees hanging from trees**
 - **Step One:** make a fire to prepare the smoking material. Fill the smoker with burning charcoal and the smoking material.
 - **Step two:** put on the protective clothing and smoke your clothing and have all the required tools ready.
 - **Step three:** Smoke the swarm gently.
 - **Step four:** Shake and brush the bees into an empty catch box or sac. If most of the bees have fallen into the catch box or sac, you can almost be certain that you got the queen. Search for the queen and put her in the queen cage or matchbox.
 - **Step five:** Hiving the swarm. Tie the queen cage on the middle top bar. Place the queen excluders or money or paper clips on the entrance holes of the hive. Release the queen after two weeks. Remove the queen excluder or money or paper clip after a week.

■ **Capturing bees using swarm boxes**

Bees can also be captured using swarm boxes. A swarm box is a small top bar hive with the same width dimensions, but covered with fewer top bars. It should have an entrance hole of about 5 cm long and 1 cm high. The swarm box has to be baited and sited during the swarming period.

- **Step one:** Bait the swarm box by smearing the inside, entrance and top bars with beeswax. On the top bars, only apply beeswax on the middle of the glove.
- **Step two:** Hung the swarm box high in trees or rooftops to easily capture swarms looking for a new home. Monitor the swarm boxes frequently for bee occupation.
- **Step three:** After 3-4 weeks of occupation, transfer the trapped swarm into the top bar hive. Transfer the top bars with combs into the main top bar hive and remember to place the combs in the same order. Smoke and brush the remaining bees into your top bar hive.

- **Step four:** After transferring the colony into the hive, re-site the swarm box for more colony capture.



Figure 16. Capturing bees using a swarm box (Source: Zamukwa)



Chapter 5

5.0 Bee and apiary management

How to manage bees and the apiary?

Just like all businesses, Apiculture has its own unique challenges mostly in the form of pests, diseases and poisoning from chemicals. Generally, diseases rarely trouble beekeepers in Zambia. In most cases a strong colony should withstand some pests and diseases.

5.1 Management Calendar

Apiculture calendar reproduced from Zulu (2010) who adapted it from Clauss and Clauss (1991).

Main flowering seasons, bee activities and beekeeper's duties

JULY-AUGUST

Beginning of the yearly Bee calendar

Floral activity (Trees in flower)

- *Marquesia macroura*, *Parinari curatellifolia*, *Syzygium* species, *Cryptosepalum exfoliatum*, *pseudotaxus* (See section 8.2 Major nectar and pollen producing plant) Citrus species, among others.

Bee activity: Colonies start building up (Breeding), first swarming and migrating.

Beekeeper's Duties: Repair, clean, bait, and place empty hives till July, before swarming starts. Make fire breaks or do early burning till end of July.

AUGUST-MID OCTOBER

Tree species providing main nectar

- *Brachystegia spiciformis*. Local names: Muputu, Kampela (Bemba names), Manga, Mpazhi (Kaonde name), Mputi, Mutuya (Lozi names), Mupuchi (Lunda name), Mputi (Nyanja name), Musewe (Tonga name)
- *Brachystegia floribunda*. Local names: Musompa, Chifwanga (Bemba names), Musobo (Kaonde and Lozi name), Mubombo (Lozi name), Msamba, Mvunkwe (Nyanja names)
- *Brachystegia longifolia*, Local names: Muombo, Chombwe (Bemba), Musamba (Kaonde and Lunda name) Mubombo (Kaonde and Lozi name), Mbovu, Msamba, Mchenga (Nyanja names).

Bee activities: Breeding continues rapidly leading to swarming in August/September/October, occupying well-baited hives.

Beekeeper's Duties: Capture and introduce swarms into hives, control pests.

MID OCTOBER-NOVEMBER

Few flowers except late:

- ***Brachystegia longifolia*** (see above for local names).

Early weeds in cleared and fallow areas:

- ***Tribulus terrestris***. local names: Kanjate, Malanatwa (Lozi names), Lipotho (Luvale name)
- ***Nidorella resedifolia***. Local names: Lusonga (Bemba name), ilondolondo (Lunda name), Vumbavumba (Kaonde), Nsimu (Mambwe)

Bee activities: Breeding stops and then starts again at low level.

Beekeeper's duties: Harvesting of honey and processing of beeswax.

DECEMBER-JANUARY

- Few flowers on most plants, but rather more in herbs and other weeds in cleared areas.

Bee activities: Breeding still slow. Many abscondings due to lack of flowers and faulty hives.

Beekeeper's Duties: Maintenance and repairing of hives, control of pests and harvesting of honey continues on small scale.

FEBRUARY

More weeds start to flower again:

- ***Bidens pilosa*** (Black jack). Local names: Kasokopyo (Bemba name), Kukulume (Luvale name), Nzonzonzu (Lunda name)
- ***Tridax procumbens***. Local name: Katendo (Nyanja name),
- ***Hibiscus species***. Local names: Sansamwa (Nyanja name), Kombwe (Bemba name)
- ***Triumfetta species***. Local names: kalamatila (Nyanja name), Namatana (Bemba name)
- ***Tagetes minuta***. Local names: kanunka (Nyanja name), Mutanda zyeelo (Tonga)

Bee activities: colonies build up again and first swarming occurring at the end of February.

Beekeeper's duties: repair, clean, bait and place hives till mid-February.

MARCH

Nectar flow starts with:

- ***Julbernardia globiflora***. Local names: Mpasa (Bemba name), Katondomumba (Lozi and Kaonde), Mwanza (Lozi), Kabunga (Nyanja), Kamponi (Nyanja and Tonga), Mumba, Sandwe (Tonga).
- ***Julbernardia paniculata***. Local names: Mutondo (Bemba, Kaonde, Lozi and Tonga), Muchesa (Bemba), Mwanda (Lunda), Mtongo (Nyanja).
- Weeds of last month and other late weeds of cultivated and fallow land.

Bee activities: From end of February swarming and occupation of well-baited hives is prevalent.

Beekeeper's activities: Constantly re-bait unoccupied hives or capture and introduce swarms into hives.

APRIL-MAY

- Peak of nectar flow from trees which started to flower in March including *Phyllocosmos lemaireanus*. Local name: Kampombwe, Musengameno, Mwembembe (Bemba), Chikuku, Mutukumwishi (Luvale), Mulumbwelumbwe (Bemba, Kaonde, Lunda, Lozi), Kapulula, Mdimba (Nyanja), Muliapwela (Tonga).

Bee activities: Swarming and occupation may continue especially in cultivated areas.

MAY-JUNE

- Few flowers left in most areas.

Bee activities: Breeding generally decreases.

Beekeepers activities: Harvesting season. Making fire breaks or early burning around apiaries.

5.2 Pests

Safari Ants: Safari or red ants attack colonies for honey. Honey bees often abandon hives when invaded by safari ants.

Solutions

- Keep the apiary clean by slashing grasses around hives and monitor for safari ant invasion.
- Applying wood ash around the cleared hive stands discourages safari ants.
- Treat hive stands with used oil or place stands in containers filled with water.



Figure 17. Safari Ant (Source: © Bernard DUPONT)

Honey Badger: Honey badger is a powerful mammal which attacks colonies for their honey and broodcombs.

Solutions

- Use suspension wires to place beehives about 1.5 m above the ground.
- Alternatively, place beehives in a safeguarded bee house.



Figure 18. Honey Badger (Source: [congonaturalist](#))

Bee Pirates: Bee pirates are slender wasps with yellow-brown and black cross stripes. These wasps' prey on flying worker and queen bees.

Solution

- Ensure that you have a strong colony by having good management. A strong colony is able to overcome loss of a queen or worker bees.



Figure 19. Bee Pirate (Source: © Ryzhkov Oleg)

Greater Wax Moth (*Galleria mellonella*): Wax moths lay eggs in hives. Larvae of this moth feed on combs. They destroy combs with their movements and leads to bees absconding their hives.

Solution

- If a colony is affected with the wax moth remove all damaged combs, wax moth larvae and cocoons.
- Seal all cracks of the hive. Keep the hive clean and free from any old combs.



Figure 20. Greater Wax Moth (Source: © Ken-ichi Ueda)

Large Hive Beetles: Some beetles eat small amounts of honey and the brood and they are a serious nuisance during the rainy season.

Solution

- During hive inspections check, and physically remove and kill beetles.
- Ensure entrance holes to hives are about 1cm wide.



Figure 21. Large hive beetle (Source: © riana60)

Small Hive Beetle: These are little brown insects that are often attracted in large numbers by the smell of pollen and honey. They lay eggs in pollen cells.

Solution

- Ensure that you have a strong colony through good apiary management. A strong colony is able to successfully remove the emerging larvae.
- Physically remove the beetles during inspections since bees cannot grab or remove adult beetles.



Figure 22. Large hive beetle (Source: © Mike Quinn, Austin, TX)

5.3 Diseases

European Foul Brood

The European foul brood manifests itself through larval death and it melts the brood in their cells. This disease significantly reduces productivity.

Solution

- Encourage development of a strong colony through good management (conserving and planting bee plants among others). A healthy colony is able to remove the dead larvae.
- Remove or harvest old and dark brood combs as they are prone carriers of foul-brood germs.



Figure 23. European Foul Brood (Source: www.beeinformed.org)

Chalk brood

This is a disease of the honeybee larvae. It causes the death and mummification of sealed brood (the dead brood appear preserved when removed from the brood cells) with consequent weakness of bee colonies. It rarely kills a colony, but will weaken it, hence reducing honey production.

Solution

- Encourage the development of strong colonies. A strong colony is able to overcome infection.
- Improve ventilation and ensure that the interior of the hive is always dry.



Figure 24. European Foul Brood (Source: www.beeinformed.org)

Nosema

This is a disease that affects the intestines of adult bees. This disease manifests itself through diarrhoea of the bees. Infected colonies have poor honey yield.

Solutions

- Ensure that you have an effective wind break which doesn't allow the spread of the protozoa that causes the disease.
- Feed the diseased bees with soy flour.
- Feed the bees with sugar syrup with a dose of 30 mg of active component fumigillin per liter in a ratio of 2:1 (sugar syrup: fumigillin).
- After bringing the disease to manageable levels transfer the bees to a clean hive and decontaminate the affected hive.



Figure 25. Nosema (Source: D. Broberg, www.flickr.com/photos/dbroberg)

5.4 Bee poisoning from chemicals

Honeybees are very sensitive to chemical sprays. They are easily poisoned when they come in contact chemical sprays or when they visit sprayed crops. A sure sign of bee poisoning is the presence of thousands of dead bees around the hive.

Solution

- Site the apiary away from crop fields that are regularly sprayed or ensure that there is no or minimal spraying to crops closer to the apiary.



Figure 26. Bee poisoning (Source: www.beeperfect.com)



Chapter 6

6.0 Harvesting and processing

How to harvest combs and process honey and beeswax?

6.1 Harvesting of honeycombs

There are two honeycomb harvesting seasons in Zambia: 1) between **October** and **November** for *Brachystegia* species dominated forests and 2) between **May** and **June** for *Julbernardia* species dominated forests.

Harvesting should be done early in the morning or late afternoon when it is cool and the bees are confined to their hives. Prepare the following utensils for harvesting: **plastic containers** for carrying honeycombs, a **knife** for cutting honeycombs, a **brush** for removing bees from the honeycombs, **protective clothing** (bee suit), a **smoker** to help provide smoke and a **torch**. You should have at least a helper for easier harvesting.

Before harvesting, prepare the smoke in a smoker. Smoke the hive entrance gently. The smoke will pacify and push the bees to one side of the hive. Remove the hive cover of modern beehives (Kenyan top bar or Langstroth hive) and start harvesting by removing top bar by top bar while continuing to blow in small puffs of smoke. Continue cropping until you reach the brood area. For the Langstroth hives only harvest the supers. Leave enough honey for the bees to feed on; otherwise, they may abscond to a new home. Once you have finished harvesting remember to cover back the hive.



Figure 27. Field Harvest (Source: Zamukwa)



Figure 28. Pure and sealed honeycomb (Source: Zamukwa)

6.2 Honey processing

Impurities such as pollen, dead bees and other debris should be removed from honeycombs before processing. Grade honeycombs into three grade types. Each grade of the honey combs should be processed separately. There are different methods of processing honey.

Honey processing using the centrifugal honey extractor: This is the best method of processing honey from honeycombs. There are manual and electric centrifugal honey extractors. These machines are however expensive.



Figure 29. Centrifugal honey extractor

The centrifugal honey extraction method works well with honeycombs on top bars with frames. You simply insert the frames in the centrifugal honey extractor and you spin the honeycombs at high speed and the honey will be extracted.

Honey processing using a press machine: The use of a honey press machine is relative cheaper and simple compared to centrifugal honey extractor. To process honey using this method, first break up the combs and place the broken pieces into a honey press with a clean cloth or mesh wire inside. Apply pressure on the combs to extract the liquid honey and collect the liquid honey in clean buckets.



Figure 30. Honey press

Traditional hot water bath method

- Light a fire. Put a big pot with water on the fire.
- Break honeycombs and place them in a plastic container. Tightly close the container.
- Place the plastic container in the big pot with water on the fire. Make sure the plastic container with honeycombs does not sit directly on the bottom of the big pot.
- The fire heats the water which in turn heats the broken honeycombs in the plastic container. Ensure that the honeycombs melt into a molten liquid.
- Pass the molten liquid through a Calico cloth to remove any debris.
- Leave the clean molten liquid to cool. Wax will form on top (float and solidify). Simply scoop out the wax with a big spoon until you remain with pure honey.
- You then have processed honey ready for bottling once all the wax is removed.

6.3 Processing of beeswax

After extracting honey from honeycombs, the empty combs can be processed into beeswax, another valuable bee product. To process beeswax, prepare two pots for heating the combs, two straining containers, two pieces of sacks for straining, a piece of rope for squeezing out the wax and soap or detergent. You can process beeswax as follows:

- Place empty honeycombs and or crude wax into a container.
- Fill the container with an amount of water equal to the combs.
- Bring the mixture to just below boiling point and stir continuously until the mixture is like soup.
- When all the wax is melted, pour it through a straining material held over a second empty container. The straining material should be held by two helpers.
- Squeezes out the molten wax from the straining material.
- Leave the mixture of water and molten wax to cool and a solid layer of wax will float to the top of the water and solidify.
- Break the cake of wax into a clean container and add a few drops of water. Repeat the heating process until you get a clean cake of beeswax.



Chapter 7

7.0 Honey quality

What and where to access honey quality tests?

To ensure honey quality in Zambia, the Zambia Honey Council and the Zambia Bureau of Standards introduced a certification scheme in 2008, which guarantees consumers that honey is packaged in a hygienically clean processing facility and conforms to high hygiene standards. Honey that conforms to high standards in Zambia will have quality assurance (QA) mark on the label. The QA logo on honey jar or bottles indicates quality assured. This quality assurance mark is granted to processing and packaging companies, not beekeepers. In order to acquire the quality assurance (QA) mark the company's processing facilities should be inspected by the Zambia Bureau of Standards. The company has to pay a fee for inspection and the fee depends on the location of the factory.

Beekeepers who sell honey to companies are also encouraged to follow basic field standards. Some of the quality assurance standards beekeepers should uphold at to ensure quality include:

- Honey containers must be clean and must not be made from copper or uncoated mild steel. Plastic containers are preferred.
- The moisture content of honey should be equal or less than 19%.
- Honey should be cold pressed or processed. The maximum temperature for processing honey in the field should be 35° C. Hence honey should not be heated, hence not use of the traditional water bath method.
- No brood should be harvested or processed.
- Dark comb should not be processed as this taint the honey.
- Taste and smell should be that of natural honey with a floral aroma and should not be bitter or have a wax aftertaste.
- Honey should have no visual signs of debris
- During harvesting, do not harvest all the honey, leave some honey for bees. Some honey should be left to maintain the colony after harvesting

- There should be minimal use of smoke and fire during harvesting. Honey should not have a smoke taint.
- It is recommended that honey combs are graded. Unripe comb must not be mixed with ripe comb.

Food quality and safety including the nutritional constituent tests can be done at the National Institute for Scientific and Industrial Research (NISIR) food lab along airport road or at the University of Zambia School of Agricultural Sciences.



Figure 31. Quality factors of honey (Source: keystone-foundation.org)



Chapter 8

8.0. Market access

How to access good markets?

8.1 What is marketing?

Marketing is a conscious effort made by a producer of a product to inform the general public of the availability of the product, its benefits, and the price. This is all done with the aim of selling the product to as many people as possible. Marketing is about finding out which products to produce in order to maximize profit. This includes making decisions on what to produce, when to produce and harvest, where to sell, when to sell, to whom and at what price and how to add value to the product. Marketing is therefore a management process that identifies, anticipates and supplies products efficiently and profitably. The success of selling any product depends on how you work around the four Ps of marketing which includes: product, promotion, price and place.

Product

Product (honey and or beeswax) is what you offer to customers. Set your mind on producing a **product** that customers want. Product quality, packaging material and brand name are to be considered to successfully sell a product.

Price

Price is the amount of money charged for a product or service. Make sure that buyers are willing to pay a price that covers both your costs and generates a profit. Factors like quality of the product, prices of competing products, brand name of the product, the incomes of key customers, number of competitors all affect the price. Ultimately price depends on **supply** and **demand**. **Supply** is what people are able and prepared to sell at a set price. **Demand** on the other hand is what people are prepared to buy at a set price.

Promotion

Promotion is a mixture of different methods that can be used to promote a product. The main forms of promotion include advertising, personal selling, sales promotion, and publicity campaigns.

Place

Marketing is also about finding the best **place** to sell your products and knowing the right way of getting them to the market place. For a product to be sold, it must be available at the right time, in the right quantities, at the right price and in the right place.

Marketing of honey and beeswax

Honey is the most important and easily marketable bee product. Other bee products include beeswax, propolis, bee venom among others.

8.2 Aggregating bee products – marketing as a group

Advantages of marketing as a group

- **Access more markets** - bulk honey and other bee products, and sell together and access markets that require big volumes.
- **Learn and share experiences** - share ideas and learn from each other in the group especially from experienced beekeepers.
- **Share market information** – In a group, you tend to share and access more market information.
- **Can acquire expensive processing equipment/facilities** – It's easier to acquire expensive processing equipment and storage/processing facilities in a group
- Easier to **access support** and funding from government and NGOs
- **Share transport costs**
- **Increased bargaining power**

Disadvantages

- Activities can be delayed because decisions are to be made by the group
- Free riders (lack of contribution from some members)
- Greediness of some group members

When working and marketing your bee products as a group, pay attention to the following factors that may weaken groups.

- Financial mismanagement
- Poor attendance to meeting
- Failure to meet objectives
- Failure to discipline members
- Poor cooperation
- Failure by members to pay membership fees

8.3 Forming an Apiculture group

To start a Apiculture group, you will need to set your objectives, develop a constitution and elect executives. If you decide to be registered, you may wish to register your group as a club, cooperative, association or company.

Objectives of forming a group

What are you going to be doing together? You need to agree on your common goal. Failure to have a common goal can lead to disagreements.

Are you going to process together?

You can choose to invest in processing equipment together. The group can then rent out the equipment to members who then do processing individually. The money raised can be used for repairs or to buy new equipment. Alternatively, the group can buy honeycomb from its members, then process it as a group and later sell bee products as a group.

Are you going to sell together?

Marketing together is the biggest advantage of working as a group. You can aggregate your honey as a group, attract buyers that want to buy high quantities. Members using a bulking facility may pay a fee to the group. The group can find markets and negotiate prices with buyers and the negotiating/bargaining power is high. The other advantage is that its easy to be located by buyers.

Constitution

The group will need a constitution to guide group operations. The content of a constitution varies between groups. Basic content should comprise:

- Name of the group
- Physical address
- Objectives/aims
- Office bearers and their duties (chairperson, treasurer, secretary, committee)
- Term of office bearers
- Members
- Termination of membership
- Disciplinary code
- Finance
- Meetings
- Elections
- Amendments to constitution
- Dissolution
- Disposal of assets upon dissolution

Registering a group

If you wish to register a club or association, you can approach the registrar of societies to obtain requirements and the form. To register a cooperative, you need to go to the local district agricultural Office (DACO). The DACO will assist with guidelines, requirements and steps on how to form a cooperative.

Advantages of registering a group

- It's easy to access support
- Easy to be located by buyers or support institutions

Cost benefit analysis

Cost benefit analysis for 10 beehives for Mr Francis Nyeleti of Kapete camp in Chongwe. Mr Nyeleti belongs to a beekeeping group that owns a processing machine that is hired at a fee to members.

			1 st harvest	2 nd harvest
	Quantity	Unit cost	Total sales	Total sales
Yield for 10 hives at 20kg/hive	200 kg	K 100	20,000	20,000
Fixed costs	Quantity	Unit cost		
Hives	10	500	5,000	0
Protective clothing	3	850	2,550	0
Smoker	1	250	250	0
Torch	1	150	150	0
Buckets	12	80	960	0
Knife	1	100	100	0
		Sub total	8,010	0
Variable costs				
Beeswax for baiting hives	1kg	60	60	0
Labour – inspections	2 days	72	144	144
Labour – harvesting	1 day	72	72	72
Labour – processing	2 days	72	144	144
Hiring of processing machine	200kg	K5/kg	1,000	1,000
Transport	1	150	150	150
		Sub total	1,570	1,570
		Profit	10,420	18,430

Assumptions

- The 20 kg per hive is yield for established colonies in areas where there is plentiful of bee flowering plants
- Beekeepers are in a group that has a honey processing machine available for hire at a cost of K5/kg.

Mr. Christopher Libongani of Kazungula owns 10 beehives. He also belongs to a beekeeping group but he opted to purchase a processing machine which he hires out to the community.

			1 st harvest	2 nd harvest
	Quantity	Unit cost	Total sales	Total sales
Yield for 10 hives at 20kg/hive	200 kg	K 100	20,000	20,000
Fixed costs	Quantity	Unit cost		
Hives	10	500	5,000	0
Protective clothing	3	850	2,550	0
Smoker	1	250	250	0
Torch	1	150	150	0
Buckets	12	80	960	0
Knife	1	100	100	0
Honey press	1	9,000	9,000	0
		Sub total	17,010	0
Variable costs				
Beeswax for baiting hives	1kg	60	60	0
Labour – inspections	2 days	72	144	144
Labour – harvesting	1 day	72	72	72
Labour – processing	2 days	72	144	144
Transport	1	150	150	150
		Sub total	570	570
		Profit	2,420	19,430

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