



Regreening Africa



INTEGRATING BEEKEEPING FOR LAND RESTORATION

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Introduction

Bee farming is rearing bees for services such as pollination and products such as propolis, bee venom, bee bread, live bees, brood, royal jelly, pollen, and honey. Bee farming has the potential to alleviate poverty and integrates well with regenerative agriculture, climate change adaptation and mitigation, land restoration and biodiversity conservation.

Integrating bee farming with land restoration initiatives that involve tree growing and management provide economic incentives to farmers through sale of bee products, creation of employment to hive makers and providing business for youth and women.

The natural vegetation cover within the forest, private and communal lands, availability of high population of the wild bee population, widespread tree planting initiatives and Farmer Managed Natural Regeneration (FMNR) provide suitable environment for bees and opportunity for farmers to integrate beekeeping with sustainable land management system.

Increasing diversity of trees on farm and community land provide high quality honey as bees need over 21 different amino acids to make honey. The type of forage also determines the taste, color, and viscosity of the honey. Tree diversity also ensures availability of forage over prolonged period due to varied flowering patterns of the trees.

Bee farming contributes to

- **Economic development** through income generation from sale of honey and other hive products sold to local, regional and export markets thereby increasing the country's Gross National Product (GNP). Beekeeping is also linked to other sectors of economy like pharmaceutical, confectionary, cosmetic that have industrial value.
- **Environmental conservation** by sustaining existing forests, promoting Farmer Managed Natural Regeneration (FMNR) and increasing the number and diversity of trees on farm to produce bee forage, shade for the hives, timber for hive construction etc. Bees fly three to five kms from the hive to collect nectar benefitting farmers across different landscapes.

- **Food security** bee farming promotes pollination increasing quality and quantity of agricultural products.; further hive products are consumed and have high nutritional value.
- **Social** inclusion beekeeping is conducted by both men, women, and youth. Also bee products are utilised across different sectors, benefiting several actors.
- **Health** bee products are medicinal, consumption of bee products is associated with better immunity and low susceptibility to diseases.



To enable farmers and project implementors design their beekeeping intervention, the Regreening Africa project funded by the European union and implemented in eight sub-Saharan African countries developed a training module to build stakeholders' knowledge and skills on trees species that are suitable for beekeeping, information on where and how to set the apiary, beekeeping equipment, bee colony management, hive inspection, bee products harvesting and honey value chain development.





Module 1:

TREES AND BEEKEEPING

1.1 ROLES OF TREES IN BEE FARMING

Trees play diverse roles within beekeeping production systems.

1) Source of food for the bees

- Bees feed on nectar and pollen that is produced from certain tree species
- Tree diversity within the farm provide the bees with several flowers that improve quality of honey (bees require up to 21 different amino acids to make honey)
- Trees flower at different seasons and for a varied period, having many different species within the farms ensures bees can access forage for a prolonged period
- Flowering crops integrated with trees provide nectar to the bees as they benefit from pollination services increasing quality and quantity of yields.

2) Trees provide home for the bees

- Offer sites for apiary establishment
- Provide materials for construction of the apiary
- Provide shade required to cool the hives
- Indigenous tree species and exotic species such as cypress, eucalyptus, Cider and Grevilia are used to construct beehives.
- Trees used to fence the apiary sites offering security to the bees
- Trees provide nesting place for bees that are absconding their current hive or the split colonies during swarming.

encouraging farmers to manage existing trees and plant more trees to produce bee forage, shade for the hives, timber for hive construction etc.

- Allowing local communities to set up apiaries within the forest or at buffer zones, promotes community natural resource management boosting relationship among environmental stakeholders



1.2 BEE PLANTS

The beekeeper should understand the type of plants available, suitable for nectar production and the flowering pattern of the plants. Critical questions to answer before settling for an apiary site:

1. What are the plants and trees that bees use?
2. Which trees or plants give the best honey?
3. Are they available in the proposed apiary site?
4. When do they flower and for how long? Note: ensure the available plants are sufficient to support the bee population to avoid negative effects on the environment.



**Table 1: some selected tree species performing different roles in a bee farm in Rwanda**

<p>Bee forage species</p> <ul style="list-style-type: none"> • Sesbania sesban (Umunyegenyege), • Casuarina equisetifolia (Filaho/ Umubuunda), • Polyscias fulva (Umwungo), • Papea capensis (Umumena), • Morus nigra (Iboberi/ umukeri), • Markhamia lutea (Umusave), <p>Beehive stands/ Construction of the apiary/shade trees</p> <ul style="list-style-type: none"> • Cypress (Sipure) • Eucalyptus globulus (Blue gum) • Casuarina equisetifolia (Filaho/ Umubuunda) • Terminalia mantaly (Teriminariya) • Grevillea robusta 	<p>Beehive construction</p> <ul style="list-style-type: none"> • Cypress (Sipure) • Eucalyptus globulus (Blue gum) • Casuarina equisetifolia (Filaho/ Umubuunda) • Terminalia mantaly (Teriminariya) • Grevillea robusta <p>Twigs for the smokers</p> <ul style="list-style-type: none"> • Eucalyptus globulus (Blue gum) • Acacia spp • Avocado • mango <p>Fencing apiary sites</p> <ul style="list-style-type: none"> • Calliandra calothyrsus • Sesbania sesban • Moringa oleifera • Senna spectabilis (Senna),
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5. When is the swarming seasons for the bees?
6. Is the proposed site among the bee swarming routes?

List of suitable tree species for different function within the bee farms from groups discussion in Rwanda can be accessed here¹

1.3 BEEKEEPING FLORAL CALENDAR

Beekeeping follows seasonal cycles. The seasonal weather impacts the bee population and production of hive products. Reduced food means that the queen lays less eggs and the population of the hive falls. Increased food means increased laying and the population increases. If the nectar flow and weather conditions are favorable, a substantial honey crop can be produced.

The bee floral calendar has three main seasons. **Dearth season** when the flowers have dropped, and bees have limited access to forage. **Build up** season that marks the start of the flowering season, the third season is the

honey flow period when the trees are at the peak of flowering, bee population is high as well as bee products. When starting a new colony, the planning process, mapping of the apiary sites, purchasing the hives should be done during the dearth seasons. Identifying sources of bee colonies is done during the dearth phase. The new colony should be established during the build-up phase, as food becomes available in increments as trees begin to blossom and continue to do so. During the honey flow season, the bees strengthen their colonies, allowing them to utilize the high food production and increase honey and other hive products.

1.4 SITING OF THE APIARY

Apiary is a place with one or more beehives used for keeping bees to harness bee products for home use or for sale. They range from a single hive to 20 hives and maximum of 50 hives and spaced 2 meters apart. Distance from one apiary to the other should be about 2-3 km apart.

1 <https://docs.google.com/document/d/1Pa13a3zKqRpsEYrKOSQEF-shGrfWwHsn/edit>



Successful beekeeping is a factor of good quality bees, strong queen, sufficient and diverse food sources and efficient colony management. The success and sustainability of beekeeping depend on where the beehives are kept.

Once the place has suitable bee plant, also consider;

Water access and security

- The apiary must be near a fresh water supply.
- Water should be provided to bees during dry season.

Environmental conditions.

To be favorable for the bees, the area should be:

1. Shaded to avoid direct sunlight, raindrops and strong winds
2. Fenced to minimize interference
3. Free from pesticides.

Location

1. Easily accessible for inspection
2. Good drainage to avoid fungal infections, promote honey maturation and allow bees to forage
3. Near forage trees and crops ≤ 3 km
4. Away from building, noisy, smoke, fire.

Preparation of an apiary site

1. Clear the sites of excess vegetation, level the soil and remove stones and other unwanted materials
2. Fence off the apiary using live fence, barbed wire, or others fencing materials
3. Install shade trees around the hives
4. Treat hive stands to avoid attack by termites and rotting of wood, hang the hives.







Module 2:

BEEKEEPING EQUIPMENT

There are several equipment used in beekeeping. They could be modern or traditional made from a variety of materials, depending on availability and technological advancement. Beekeepers use logs, straw, clay pots and banana leaves to make traditional beehives then swarming bees would settle in.

Advantages of traditional technology

The traditional hives have several advantages:

1. Hives are simple to construct
2. Once placed in a suitable position the bees colonize and build the comb.
3. Beekeepers visit hives infrequently only to install and harvest
4. The hives produces high bee wax volumes
5. Require limited skills to operate
6. Locally available and less attractive to thieves.

Disadvantages of the local technology

The hives are faced with limitation that include:

1. Low honey production and low quality due to impurities
2. Swarming is common
3. No room for expansion
4. Loss of brood during harvesting
5. Difficult to manage the hives and to collect honey and the royal jelly.

Because of the challenges presented by the traditional hives, researchers invented modern hives:

1. To promote easy inspection of bees by including movable frames or top bars
2. Control swarming by moving frames with brood and queen cells to empty hives
3. Extract honey without breaking combs saving time and energy required by bees to make combs, which are then invested in producing more honey
4. Create room for expansion within the hive by adding more frames.

Modern bee keeping involve use of equipment which ranges from langstroth hive, Kenya top bar hive (KTBH), box hives and processing equipment which allows the beekeeper to take more control on the bees.

Advantages of using modern hives

The main advantages of modern beehives are:

1. Combs are movable, encouraging hive management
2. Easy to control swarming
3. Honeycombs are recycled
4. Use of honey extractors increase honey quality
5. More volume is produced due to the increased number of frames, particularly during the honey flow period.

Disadvantages of using modern technology

The modern technology is however limited by:

1. Technical skills required to construct and manage the hive
2. Frequent visit to the hive may cause the colony to abscond
3. Sometimes the hive colonization rates are low.
4. Farmers need to be trained on managing the hives and bees
5. Some cost are attached to beefarming using the technology

2.1 EQUIPMENT USED IN MODERN BEEKEEPING

Apart from beehives, modern beekeeping incorporates:

- **Protective clothing** used during hive inspection, harvesting and processing that include veil (headgear), coverall (protect the torso), gloves (protect the hands) and gumboots (protect the feet).
- **Hive tool** for opening the hives to loosen the propolis seal.
- **Fork** for cutting off the honey from the frames/ top bars
- **Centrifugal extractor** for squeezing the honey from the frames/ top bars
- **Honey press** for squeezing honey from traditional beehives
- **Double sieve** for straining the honey to filter off any solid substance and remain with free flowing honey
- **Buckets** for holding the processed/ unprocessed honey for packaging. The buckets should be made of white food grade plastic or stainless steel as honey is corrosive.



2.2 SUITABLE TREE SPECIES FOR MAKING BEEHIVES AND THEIR FEATURES.

Cypress

Advantages

1. Withstand high temperatures and rain.
2. Not attacked by insects
3. It used as a boundary tree by many farmers in humid areas.

Disadvantages

1. Expensive to purchase.
2. It takes longer to mature to the size required for making hives.
3. Not colonized easily by the bees.

Grevilia robusta

Advantages

1. The timber is flexible to allow nailing even at the timber edge without cracking
2. It is an agroforestry tree and integrates well with crops and contribute to soil water availability.
3. Yellow leaves of the tree are bee attractant.
4. The timber is widely available.

Disadvantages

1. Prone to wood weevils if stored in the store
2. At the young age they are highly attacked by the termites on the stem
3. Poor distribution in the timberyard.

Blue Gum Tree

Advantages

1. Most available in the wood distribution points
2. Natural scent of the wood serves as bee attract hence facilitate colonization
3. Fast growing and establishes well within woodlot.

Disadvantages

1. Splitting while nailing at the wood edges.

Pinewood

Advantages

1. It is spongy and allows nails without splitting.

Disadvantages

1. Exposure to the general harsh environment of rain and sun causes rapid deterioration
2. Some bees do not like the natural scent of the wood, which affects the colonization rates of beehives made from the wood.

2.3 TOOLS FOR HIVE DEVELOPMENT

Working bench, tape measure, pencil, harmer, square, saw, crump, pliers, drill.

Other hive materials required

- Nails. Imported model, thin and smooth to allow penetration into the wood
- Standard queen excluder
- Comb starter's sheets
- Spacer sheets
- Wood glue
- Paint
- Plywood
- Plain sheet of gauge 32 inches that can be easy to fold without taking to blacksmith
- Stainless string.

Tools handling and safety

- For the farmers to be efficient with the tools, waist arm flexibility exercise is needed
- Tools must be sharpened
- Farmers should be guided on how to read the measurement correctly, the most critical is the reading of the tape measure, square and saw tools; farmers should learn what tool to use when and for what purpose
- All the tools and materials must be cleaned and returned to their respective storage positions.





2.4 PROCEDURES FOR MAKING THE BEEHIVE

- Measure size required: This will help in reducing timber waste plus cost. See required dimension for each part described below.
- Cut the pieces for each part: This will help in managing time for developing the hive and ensures right pieces for the right part.
- Planning of the timber: This is done to the gauge of 0.75 inches to create uniformity and free wood from splitting.
- Rebeet making on the timber: This gives the frames a place to rest on in the hive in both the super and brooder.
- Grooving of the timber: The grooving is done to create a maximum joint without space in the brooder part. This will control pest from getting into the hive.
- Joining the pieces using glue nail and crump of brooder and super: This helps maximum control of the open spaces.
- Fixing cracks with glue: These cracks are sealed to control part that the pest's eggs can be laid.
- Sand papering to attain surface smoothness: Done on the outer part to help in the surface work for the paint to be spread on.
- Fixing spacers at the edge: Helps in creating aeration in the hive, allows spacing between the frames to create movement freedom for the bees as the ascend to the super through excluder. Makes it also easy to pull out the frames while doing inspection.
- Making of the inner frames that carry the combs in them.
- Making of the inner cover: Helps in creating optimum hive temperature.
- Comb starter fixing: This helps in guiding the bees in the comb construction, acts as an attractant for easy colonization.

- Making of the outer cover: Protects the scorching sun and the rains from hitting the hive directly.
- Fixing of bottom board: Gives direction of bees entrance as it holds the two entrance points. Helps farmers during relocation of colonized hived from trap point to the apiary.
- Painting the hive: This is a fast dry paint and takes 10 minutes to dry. It has no bad smell that can deter the bees from colonizing the hive.
- Branding: This gives identity of the source, helps in record keeping per hive in terms of specific inspection.
- Putting in place the queen excluder. This will control the movement of both the queen from laying eggs in honey unit reducing quantity and quality honey production. The drone is controlled from accessing the super as it will eat honey.





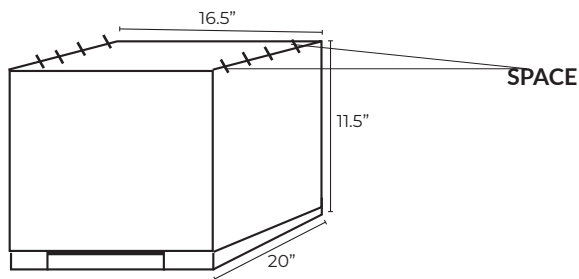
2.5 FEATURES OF LANGSTROTH HIVE

- **Bottom base (Its dimension is 16.5" width and length of 21"):** It has the framing with groove for the bee entrance. Helps to control the in and out of the bee movement and hold the entire hive structure. The extra space is for bee landing.
- **Brooder box (width-16.5", depth -11.5" and length-20"):** This chamber holds the Queen Bee, Drone bee, Worker bees. Here you will also find the frames that hold the comb cells of queen, brood, pollen, worker and honey cells. For the safety of the queen bee against injury of its delicate body, the worker bees will smear the propolis around to smoothen the surface.
- **Frames for the brooder (length 19 ¼" by width 11"):** Combs containing pollen, beebread, eggs, queen, house bees and drones are held firmly by the stainless wire within the wooden frame. The increased depth allows big workers population that works on the speedy comb development and honey production.
- **Standard Queen Excluder (Dimensions are 16.5' by 20'):** Gives total control of the Queen. If it gains access through the ordinary building wire mesh, it lays eggs in the cells designated for honey, leading to low honey production.
- **Super (width-16.5", depth -8" and length-20"):** holds the frames with combs holding the honey. Acts as a store for the extra honey made by the bees for consumption during the dry spell.
- **Frames for the super (length 19 ¼' by width 7 ½'):** made from stainless wire within the wooden frame for holding combs for honey production.
- **Spacer:** A space of 2 inches is allowed from one frame to another to allow free movement of frames for ease of inspection and harvesting of the honey.
- **Inner cover (Dimensions are 16.5" by 20"):** Helps in regulating cold and hot temperature for the optimum hive performance of the bees in the hive. It also for ease of access to the super boxes as it is possible to remove the propolis.
- **Outer cover (Measurements are 24" by 18"):** Helps in controlling bees from the direct rains and the scorching sun. it also protects the hive from destruction from the prevailing environmental conditions.

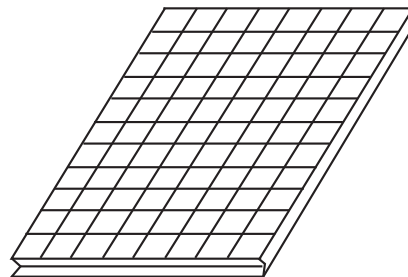




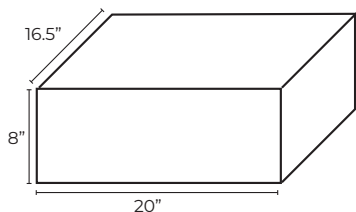
2.6 PARTS AND DIMENSIONS OF A LANGSTROTH BEEHIVE



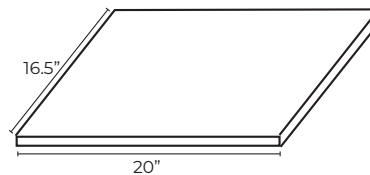
BROODER



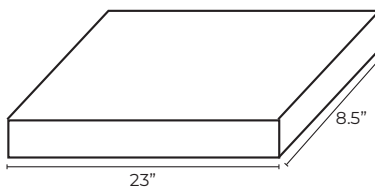
STANDARD QUEEN EXCLUDER



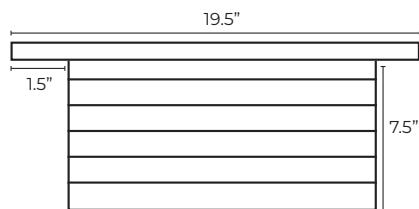
SUPER



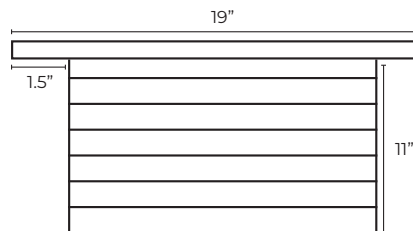
INNER COVER



OUTER COVER



SUPER FRAME



BROODER FRAME





Module 3:

HIVE STOCKING

There are many ways to attract the bees to the hives.

3.1 CATCHING A SWARM

When the population of in a hive exceed the available space, bees split and move to look for new hives. such bees can be caught and kept in an empty hive.

3.2 USE BEE ATTRACTANTS OR BAIT

- Beeswax, propolis and lemon grass applied on the frames/top bars
- Recycle the comb
- Smear some honey at the entrance and inside the hive
- Use eucalyptus leaves

3.3 COLONY DIVISION

1. Select a healthy, strong and big colony that has brood, eggs, queen cells, pollen and honey
2. Pick the brood with queen cells, destroy all the queen cells leaving only three of them
3. Move more combs with sealed and unsealed cells and others with food. Put the brood combs in the middle and the honeycombs on either side to insulate the brood nest
4. Shake in some bees as well into the new hive ensuring the queen remain undisturbed in the old hive.
5. The bees will look after the queen cells in the new colony and a new queen will hatch out. The first queen to hatch out will destroy the other queen cell.
6. Feed the bees as they understand the new site

Note

- When dividing a colony, do it at night
- Smoke the new and hold hive with the same materials as bees are sensitive to smell
- Move the new hive with the divided colony to a site about 3km away from the old site or retain in same site 3 meters apart with old and new hive adjacent to each other
- Two weak colonies can be combined to make one strong colony, a weak colony can be united with a

swarm

- When bees are seen collecting nectar two weeks after uniting/ dividing colonies, it means that the new colony is established and functional.

3.4 BUYING BEES

Some farmers have ventured into production of bees for sale. The bees can be of different types depending on the size of the colony, age of the queen health of the bees and condition of the equipment.

1. **Nuc bees** contain a mated queen that is used to start a bee colony
2. **Established colony** contain brood, food, highly productive queen. Buying such bees are very expensive
3. **Swarm cell** also called split cells. Some farmers split and sell the swarming cells

Buying bees is advantageous as it avoids the need to figure out how the hive will be colonized. The main challenge of new colony is their first dearth phase when the food is too low to sustain the bee colony.







Module 4:

COLONY MANAGEMENT

4.1 HIVE INSPECTION

Getting the bees into the hive is one thing and maintaining the bees in the hive is another. Hive inspection is among the ways of hive management. There are two types of inspection, a **general inspection** to see the health status of the colony from outside and **specific** for the brood. To conduct specific inspection one needs to open the hive, examine the egg laying pattern, availability of food, strength of the queen, new queen cells, size of the bee population among others.

During inspection approach the hive from the rear to avoid obstructing the passage route of the forage bees.

When doing a general inspection

- Remove first frames from the right, inspect it as per the checklist and table below and place it outside the hive. Do the same for all the other hive but in sequence.
- After inspection return the frames to the hive following the same sequence.

Brood inspections examines

- The fourth- seventh frames.
- Start by inspecting the third frame to create room for reaching the fourth frame without killing the bees.
- Inspect as per the checklist and table below then return them to their original positions.

Checklist for hive inspection

- Should be done in the morning. Take the shortest time possible and avoid rainy and windy days. Inspecting in the evening exposes the brood to cold.
- The movement of the bees in and out of the hive; weak movement could mean the bees are sick,
- Buzzing sound-if loud and continuous means the queen is strong and the colony is strong
- Status of the hive-any dents that need repair
- Assess availability of brood cells at different stages of development egg, larvae, pupa
- Check bottom board on the hive to determine presence of dead bees, pests
- Check if bees are preparing for swarming or for supersedue queen cells.

Age of the comb

Young combs have a clear color, as it grows, it turns yellow and dark brown when very old. When young brood is lifted to the sun, it is possible to see through but not possible to see through with old combs. Old combs can be used as beeswax. The challenge of using the same comb or an old comb is that the cells are reduced in size, resulting in smaller bees and a weaker colony; therefore, it is essential to remove the combs periodically. Very dark combs also affect the color of the honey produced and its quality.

4.2 FEEDING THE BEES

There are cases when available forage is limited and not enough to meet the food required by the bees. In such cases the solution is to feed the bees. Bee food can be prepared in the following ways:

1. Collect sugar, hot water, and container
2. Mix one-part sugar to one-part hot water, avoid boiling the mixture
3. Add a teaspoon of honey and stir the mixture together
4. Pour the solution in an open container outside the beehives for bees to feed. Alternatively you can install feeder boxes inside the hive
5. Put the feed opposite the entrance to keep away the robber and scout bees from seeing and robbing it
6. Avoid sugar spillage as it attracts ants and other pests which have negative effects on the hive.

Notes

- Feed the bees in the evening. Avoid feeding them at midday.
- Prepare food for one day only.
- Stop giving bees syrup if they don't take it immediately or leave it untouched for the whole day
- Apart from sugar, cassava flour can be used in making the syrup
- Always provide water for the bees to help them cool the hive and prepare food especially when the availability of nectar sus is low.

**Table 3: common bee pest, effects on the bee colony and how to control**

Common pests	Damaging effects and how to control
Hive beetle	<ul style="list-style-type: none">• Feed on pollen, honey, and the drone brood. Honey harvested from infested hives is poor quality and short shelf life.• Control: Use holes instead of slits for the entrance, keep strong colonies or hand pick or destroy them if found in hive.
Birds	<ul style="list-style-type: none">• Catch the worker bees in flight and can eat them.• Control: scare the birds away
Red and black ants	<ul style="list-style-type: none">• Are too small to be stopped by hive guard bees, they suck out the honey and kill the pupae and eggs, resulting in bees abandoning their hives.• Control: Hang hives and grease hanging wires regularly. Spread ashes around posts holding hives, keep grass short and branches from touching hives, make hive parts fit together without gaps, if hives are on stands, place legs of stands in tins of old engine oil.
Wax moth	<ul style="list-style-type: none">• Larvae of the wax moth feed on the comb and sometimes the woodenware of the hives, infestation of hives with these larvae results in destruction of combs leading to bee colony weakening and eventual migration.• Control by having a strong colony, remove old combs that bees are unable to cover in time of food scarcity when colony size shrinks, avoid holes and cracks in top bars and hive body where wax moths can lay eggs.
Termites	<ul style="list-style-type: none">• Feed on the woodenware of hives leaving apertures and openings that would allow other pests to access the hives.• Control: treat posts used for hanging
Lizard	<ul style="list-style-type: none">• Sighted in the proximity of hives or living between the lids and the main bodies of the hives feeding on adult worker bees crawling outside the hive.
Mice	<ul style="list-style-type: none">• Mice destroy combs, its urine has a repulsive odor and cannot be cleaned out by the bees resulting in adulterated honey at harvest. They are common in apiaries located near woodlots or in banana tree groves.





Module 5:

HARVESTING OF HIVE PRODUCTS

5.1 DETERMINANTS OF PRESENCE OF READY PRODUCTS IN THE HIVE

1. When there are several bees roaming outside the hives
2. When the bee behavior changes, bees become hostile when the honey is ready
3. During inspection you can observe some oily materials on the bee entrance
4. The smell of honey around the hives.

What to do before harvesting

1. Put on the protective gear. If the group has an appropriate apron with a veil, wear it. If not, improvise by wearing leather clothing, a helmet with a neck scarf, and a mask.
2. Smoke the entrance and give the bees five minutes. Tap the frames/ top bars using hive tools; hollow sound means no comb. Honeycombs are usually at the end of the hive opposite the entrance.
3. Inspect the hives to check availability of the honey, if the group/farmer uses Langstroth hive open the hives, super box, and use a knife to check if the comb has sufficient honey to be harvested. Do this by picking one frame at a time and harvest frame that have capped honey filled upto 3/4. Leave the unsealed honey for future honey production. Capped honey is creamy/ white in color and has irregular shape. Capped brood is brown in color and could be round or flat shaped depending on whether it contain worker or drone cells.
4. If the hive is ready, prepare a smoker using the same species as those that bees obtain nectar from. The aim of this is to prevent contamination of the honey by smoke. To improvise a smoker, place a bucket containing a few pieces under the brooder to lull the bees to sleep and collect the honey.
5. Brush off the bees from the frames if using a traditional beehive. If you do not have a brush use twigs to brush the bees. **For the traditional hive**, cut off the honey from the combs using a sharp knife into a clean white bucket. Squeeze the honey from the combs on site and return the residues to the super box for bees to consume to help them make more honey. **For the modern hive**, put the frame in

the centrifuge machine to squeeze out the honey from the frame then return the frame with the comb to the hive.

It is important to note that the quality of honey is determined by the harvesting methods. Maintain high level of hygiene to avoid contaminating the hive products. Harvest during dry season/ when not raining as the weather conditions affect the moisture of the honey. Use clean preferable white plastic buckets or stainless steel. Avoid metallic buckets as honey is corrosive and reacts with metallic substance affecting quality.

5.2 HIVE PRODUCTS

Several products are harvested from the hive as described below.

Honey

- Honey is a product of nectar from plants and enzymes produced by bees. To make honey, bees add enzymes and reduce the water content of the forage materials.
- Honey contains sugars (80-85%) that are easily absorbed by the body—good for young, old, and sick.
- As a food, honey is consumed for its rich fructose, sucrose, and glucose levels, making it a natural source of energy.
- The high sugar levels and its ability to catalyze fermentation make honey a suitable raw material for brewing liquor hence it is also used for the industrial production of local beer.
- Its antioxidant properties makes it ideal as a preservative in foods, including meat, poultry, and pastry – this is mostly by large food processing companies.





Beeswax

Beeswax is used by bees to make their combs. Beeswax is used in cosmetics and foundation sheets for Langstroth hives.

Propolis

Propolis is black and sticky substance that bees collect from some plants. It is used to cover the inside of the hive and fill in the cracks. It has medicinal value, e.g., as an antibiotic, it tastes bitter but is good for the throat and chest. There is an export market for propolis.

5.3 PROCESSING, PACKAGING, LABELLING AND MARKETING OF HIVE PRODUCTS

The process of honey collection and semi-processing are carried out by beekeepers. Some members prefer to collect and sell their produce to middlemen. Few cooperatives are engaged in honey bulking and semi-processing. To improve value addition, an additional investment and capacity building are necessary. Most traders practice honey blending. This is either to provide uniformity of the product or to meet certain trade requirements.

Honey packaging should be done in airtight containers. Ensure uniformity in the packaging in terms of, weight, volume, package ,size and shape. Packing containers used include:

- Glass containers
- Plastic containers
- Stainless steel containers

The size of containers will depend on the demand and they can be 250gm, 500gm, 750gm, 1 kg, 300kg, 500kg depending on market segments. The containers should also be:

- Attractive
- Appropriate (convenient) shape
- Affordable.
- Easy to transport.
- Clear so as to show the color of honey for the retail market.

Labelling: The label should be attractive and descriptive of the product; it should include expiry date, address, weight, nutritive value and any other relevant information. The size of the label should be proportional to the bottle/ jar or any package. Cost of label should be reasonable to ensure the price of the product is competitive.

Information on the label includes:

- Contents: Honey
- Source of the honey (for example: sunflower, mixed blossom, forest honey)
- The country and district where it was produced
- Name and address of the beekeeper
- The weight of honey in the container
- The date of packing (or the beekeeper's own code).

To penetrate the market the products should

1. Adhere to client sanitary and phytosanitary measures, and export and import guidelines
2. High quality. Various factors identified as key determinants in honey quality are harvesting methods, processing procedures and storage.

Determinants of the quality of hive products

- The hygiene practises during harvesting and value addition process
- What bees feed on, this also determine the taste of honey
- Prevailing environmental conditions, where a lot of nectar is available there is high possibility of production of sweet honey, bitter honey is also product of environment
- Honey has water. Storing honey for some time before using allow the water to evaporate leaving behind concentrated honey that has higher value.



How to determine quality of the honey

- Water level for quality honey is 19%. When too low it could have been heated to reduce the water or when too high water could have been added to it
- Adulterated honey- honey with high moisture level disperse when poured on the soil. Pure honey form a globule when poured on the soil
- Pure honey flows consistently.

Pricing of the hive products

The price of honey is determined by analyzing the cost of production, processing, packaging, transportation, labor and miscellaneous. The price should be competitive and the profit margins reasonable.

Promotion of hive products

This involves creating awareness and interest in a product. The following are different ways of promoting honey in the market: labeling, attractive packaging, free samples, advertising through: electronic and print media, international and national publications, sign boards, roadside adverts, promotional leaflets/brochures, introduction letters and by word of mouth.

Consumers

The end market of bee products are domestic consumers and export markets.

Transportation

Beekeepers use different modes of transportation to ship the harvested honey from their farm sites (or apiaries) to their homes or processing sites

- The use of motor-cycles
- Bicycles;
- Public transportation like buses;
- The use head-load.

5.4 HONEY VALUE CHAIN DEVELOPMENT

The honey value chain is all related to the provision of beekeeping inputs, production, transformation (collection & processing), distribution, consumption and finally the linkage/coordination among beekeeping partners in the value chain. The main inputs required in beekeeping are bees, bee forage, bee hive equipment and water. Extension services, finance, safe and regulated working environment are required to ensure effective functioning of the chain.

Input and service providers mainly local and modern hives providers, banks, and technical experts. Beekeepers individual producers and beekeeping cooperatives. Processors at home level, semi processing and refined processing at cooperative level. Primary transportation to the processing/ honey collection points. Packaging and labelling and finally the consumers.

The beekeepers use two types of hives: traditional hives, and modern hives. Hives are diversified in shape, volume and the materials used depends on availability and affordability.

Partners in beekeeping include:

- Government
- Private sector
- Non government organizations
- Beekeeping cooperatives.





PRODUCT OF RWANDA
AKAGERA BUFFER ZONE
HONEY

MADE IN RWANDA
AKAGERA BUFFER ZONE
HONEY

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Module 6:

STARTING A MODERN BEE FARM

Before you start beekeeping business

1. Ask yourself why beekeeping and not any other business?
 - Are the required inputs available?
 - Where will you obtain the starting capital?
 - Is the market available, how big? What is the market potential?
2. What information do you have about it ? Quantify opportunities available strength, weaknesses, threats, (SWOT analysis).
3. Determine production price, skills required, policy related to beekeeping, packaging requirements, beekeeping materials and their affordability, market and marketing strategies, how competitors behave , which innovation or solution will you bring ?
4. What are the current opportunities for beekeeping that you can build on?
 - National and global demand
 - Relevance of the beekeeping business to climate change and adaptation
 - The production technology associated with diverse bee products is more costly than honey itself.
 - Skilled young people will join and replace old beekeepers and more innovation is expected from these changes
5. Conduct honey product market research to increase your confidence level
6. List the materials required, their unit and total cost.
 - Ensure all the labor, and inputs required have been quantified before by focusing on locally available
 - Remember communication, networking, and unexpected cost.
7. Have clear information on standards, rules, and regulations available for beekeeping and bee products
 - Have in mind that your business should be social, economic, political and environmental acceptable
 - Avoid work in isolation, collaborate with others, join a cooperative
 - Use affordable materials and start with a small number which will be increased with your

experience

- Keep in mind the production calendar
- Carry out a cost-benefit analysis to ensure that the return to investment is reasonable
- Keep records of all transactions you did for the entire business cycle
- Ensure you have in place an updated business plan to guide you and your partners
- Keep learning and bring innovation.





Gross margins for integrating bees in land restoration.

When integrating bees within area planted with trees- or with naturally regenerating trees farmers can generate additional income to boost their livelihood and enable them to adapt to the climate change. We provide a scenario of apiary establishment using five Langstroth hives.

Table 4: cost of input in bee farming in Rwanda

Inputs	Quantities	Unit Cost	Total
Langstroth hives	5	\$50	\$250
Bee suit	1	\$15	\$15
Hive tool	1	\$5	\$5
Bee brush	1	\$5	\$5
Buckets (Food grade)	4	\$15	\$60
Total			\$335





Honey harvesting

Table 5: expected honey to be harvested in the first five years

Inputs	Year 1	Year 2	Year 3	Year 4	Year 5
Hives colonized	1	2	3	4	5
Volume in Kgs	5	10	20	30	40
Prices of honey USD\$ 5	\$5	\$50+ \$5	\$100+\$50+ \$5	\$150+\$100+ \$50+ \$5	\$200\$150+\$100 +\$50+ \$5
Total income	\$5	\$55	\$155	\$305	\$505
Profit	0	0	0	0	\$170

The calculations are based on the following assumptions.

1. The site has a diversity of melliferous trees with different flowering patterns.
2. The available trees can sustain the number of hives to be installed in the apiary without causing negative effects on the environment.
3. The area has other crops and cereals that could benefit from pollination services offered by the bees.
4. The farmers have received training on climate smart value chains for land restoration including beekeeping.
5. Farmers can purchase hives gradually on incremental rates, labor for colony management is provided by the farmers and products are purchased at the farm gate.
6. Farmers harvest honey once a year due to climate change.
7. In this projection, the farmer starts to make a profit in the fifth year. At that point, the farmer can procure honey processing equipment, invest in packaging and labelling.



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Regreening Africa



INTEGRATING BEEKEEPING FOR LAND RESTORATION



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