



Ethiopian TVET System



Animal Production Level-II

Training Module –Learning Guide 35-37

**Based on Version 3 March 2018 Occupational
Standard (OS)**

Unit of Competence: Assist Beekeeping Operations

Module Title: Assisting Beekeeping Operations

TTLM Code: AGR APR 2 TTLM 0919v1

October 2019



Module Title:- Assisting Beekeeping Operations

TTLM Code: AGR APR 2 TTLM 0919v1

This module includes the following Learning Guides

LG35: Prepare for beekeeping work

(LG Code: AGR APR 2 M11 LO2- LG-35)

LG36: Undertake beekeeping work.

(LG Code: AGR APR 2 M11 LO2- LG-36)

LG37: Handle and clean material and equipment.

(LG Code: AGR APR 2 M11 LO2- LG-37)

ANIMAL PRODUCTION	Date: October 2019	Page 2 of 32
Level -II Version: 1	Author: Federal TVET Agency	



This learning guide is developed to provide you the necessary information regarding the following **content coverage** and topics –

- ❖ Identifying and checking required materials, tools and equipment
- ❖ Techniques of loading and unloading materials
- ❖ Selecting, checking and using Suitable PPE
- ❖ Working safely around and with bees

This guide will also assist you to attain the learning outcome stated in the cover page. Specifically, upon completion of this Learning Guide, **you will be able to –**

- Identify required materials, tools and equipment.
- Conduct checking all materials, tools and equipment, and insufficient or faulty items reported to supervisor.
- Use correct manual handling techniques when loading and unloading materials to minimize damage to self, others, load and vehicle.
- Select and check suitable PPE prior to use
- provide Work support according to OHS requirements and supervisor instructions

Learning Instructions:

1. Read the specific objectives of this Learning Guide.
2. Follow the instructions described in number 3 to 7.
3. Read the information written in the “Information Sheets 1,2, 3, 4”. Try to understand what are being discussed. Ask you teacher for assistance if you have hard time understanding them.
4. Accomplish the “Self-checks” **in page 7, 11, 14 and 18.**
5. Ask from your teacher the key to correction (key answers) or you can request your teacher to correct your work. (You are to get the key answer only after you finished answering the all Self-checks).
6. If you earned a satisfactory evaluation proceed to “Information Sheet 2”. However, if your rating is unsatisfactory, see your teacher for further instructions or go back to Learning Activity #1.
7. Submit your accomplished Self-check. This will form part of your training portfolio.

Information Sheet-1	Identifying and checking required materials, tools and equipment
----------------------------	---

1.1. Identifying materials, tools and equipments for beekeeping work

Bee keeping equipment is material used (necessarily important) for bee keeping and also honey production. Every beekeeper should have to identify all beekeeping tools, equipments and material for doing beekeeping activities, and then prepare it for work. Before start doing with the tools and equipments, first he/she has to check its functionalities and normality. Some of the most important bee keeping equipments is: -

1. Beehive: The hive is the bees' home. There are three different types' of beehives.

I. Traditional (local) hives: - are hives made from locally available materials. The traditional (local) hives are different from place to place depending up on: Way of construction, locally available materials used to construct it and the way in which the beekeepers put. It can be made from material like clay, straw, bamboo, banana leaves, and bark of trees, logs and animal dung, woods.

II. Transitional hive. These type hives have a series of bars across the top, which allow for attachment of the comb. These bars are spaced to give the bees sufficient room to build a comb on centred each bar and to leave a bee space between the combs.

- Kenya Top Bar hives (KTBH)
- Tanzania Top Bar hives (TTBH)
- Mud block hive or chika hive.
- Chefaka (Ethio-Ribrab beehives)

These are hives with movable combs with top bars



Fig: transitional hives (Ethio-ribrib and Kenyan top bars)

III. Improved (modern) hives: These are the movable frame hives with a set of framed combs is suspended-like the files in the box. The number of frames in a hive box is determined by the width of the box and the spacing required between the frames. The bee space is **5-6 mm** for most *Apis mellifera* species of African bees. Modern hive has the following Components:

Hive stand >>>> Bottom Board>>>>Brood chamber >>>> Queen Excluder >>>> supers (may be added as needed) >>>> Inner Cover Telescoping cover (outer cover)

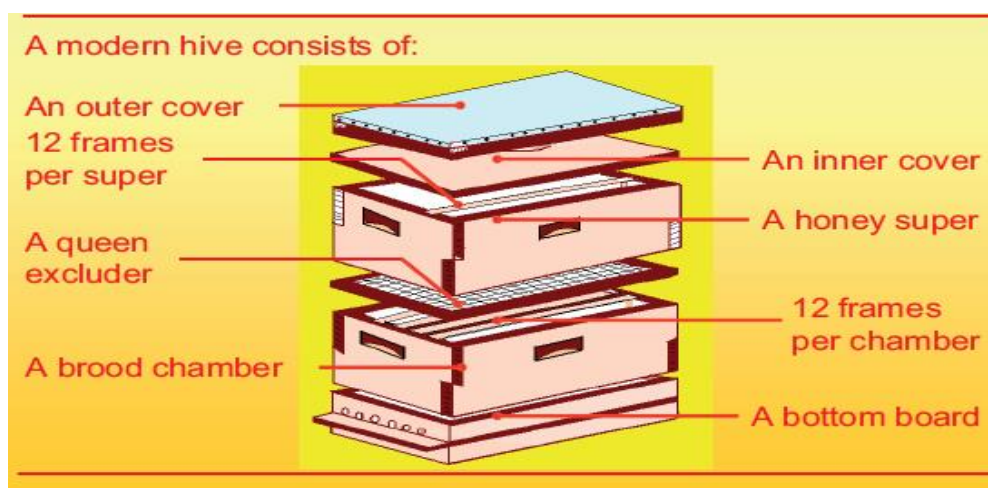


Fig 2: components of modern hive

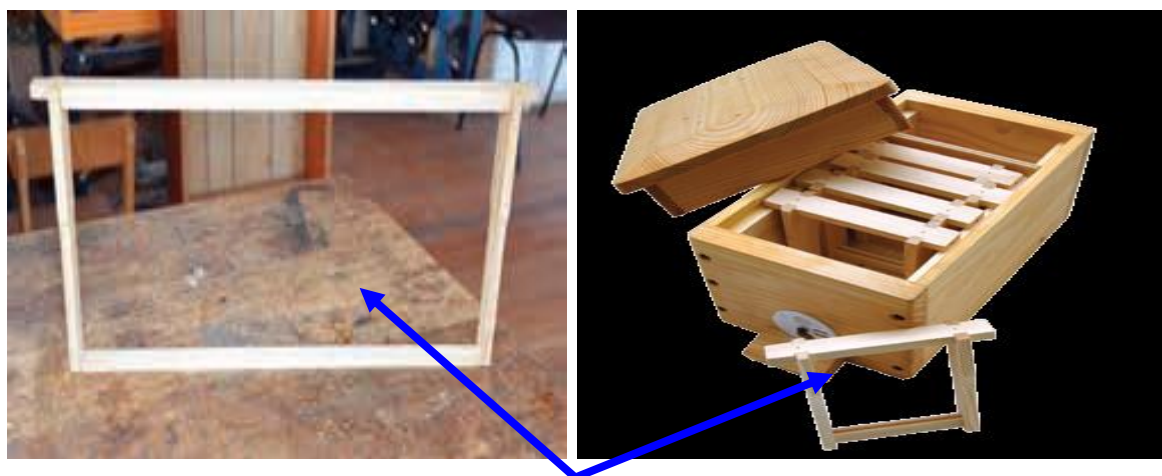


Fig3: Frames

Frames

1. Smokers



Is manually operated materials used to smoke the hive. It calms down the bees (subdue) & induce them to engorge bees full of honey are easier to handle & expel the bees from the surrounding during work.



Fig3: Bee smoker

2. Chisel /beekeepers tool

It is sharpened at both ends but curved at one end and should be painted with rustproof paint to avoid contamination of honey with corrosion and rusting with honey. It is used to open the hive, clean propels, wax and unnecessary materials from the farm, hive & seen in the hive



Fig4: Chisels

3. Casting mould /wax press/

The instrument used for making foundation sheet from bees wax with the imitation of honey comb cells. It is a metal coated with zinc. It is manually operated equipment used to make artificial comb foundation sheet

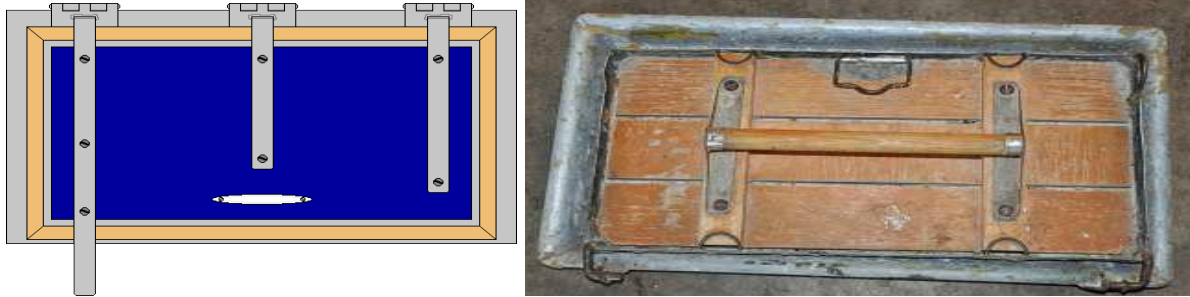


Fig5: casting mould.

4. Queen excluder

It is a sheet perforated or grid type made up of aluminum sheet or stainless steels, plastic and wire mesh that is placed between the brood chamber and honey chambers. It is a device used to form an appropriate partition between the brood and honey chambers so as to prevent the queen or drone from entering to honey chambers.



Fig6. Plastic queen excluder

6. Bee Brush



The bee brush should be made of soft natural fibre e.g. sisal fibre. One can also use bird quill feather or very soft leaves or grass provided they are clean which is used to remove the honey bees from the honey combs and draw the bees to hive while transferring



Fig 7: Bee brush

5. **Sprayer:** It is a material used to spray water on the bees/especially at low land areas/ to reduce aggressiveness and immediate evacuation from their nest.
6. **Uncapping fork/ knife :** Is a material used to de cup the cells of sealed honeycomb before the frame combs are placed in the honey extractor
7. **Frame wire:** is thin galvanized wire which is stretched through the holes of frames and used to attach & reinforce the foundation sheet to the frame. It supports the honey combs firmly during extraction, so that it will not break off easily
8. **Transformer:** - It is an electrical device having 18-24 volts and is used to fix the foundation sheet to frame wires. It converts 220 volts of electricity to 18-24 volts. In the absence of electricity, wax embedder (knife or hot wire) can be used.

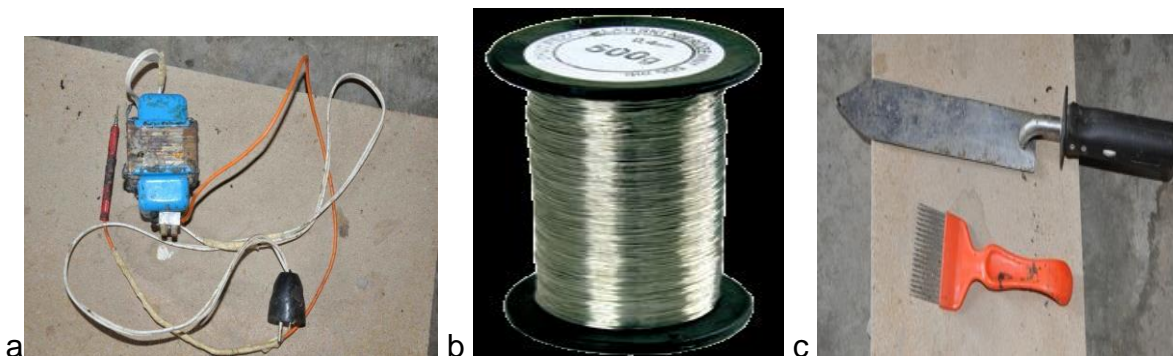


Fig 8. a. transformer, b wires c. uncapping knife and fork

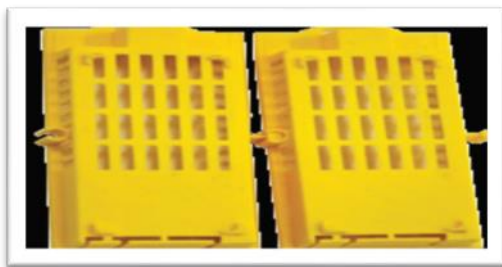


9. **Honey extractor:** It can be manually or electrically operated centrifugal machine, with removing chambers into which the frames fit. As the handle is worked, honey flows out of the frames by the centrifugal force without breaking the comb.
10. **Honey presser:** It is used to extract honey by method of hand pressing of honeycombs, which are not framed.
11. **The honey tank:** It is metal drum which is serves as a honey tank. The tank is fitting with a special **honey tap** near the bottom & a smaller tank on the top, the bottom of which is fitted with a honey-straining sieve. The top the small tank is fitted with a tight lid.
12. **Wax extractor:** Is used to separate wax from old brood combs and other impurities.
13. **Honey sieve:** Is a material that enables to separate honey from pollen, wax and other impurities. All honey as it comes from honey extractor and before it goes into honey jars should run through a strainer.



Fig 9. a-solar wax extractor, b-honey presser, c-honey tank, d-centrifugal honey extractor

14. **Honey weighing scale:** is used for weighing honey harvested.
15. **Queen Cage:** Small wooden & wire, or plastic, cage used to ship queens; usually with up to 6-8 attendant bees, also used to release them quietly into cluster.



queen cage

16. **Queen Cage candy:** A made from powdered sugar & invert sugar syrup to be used as bee-edible plug in queen cage, delaying release of queen to increase acceptance.



17. **Pollen trap:** Device installed over colony entrance with a great sized to scrape pollen pellets from legs of worker bees entering hive.

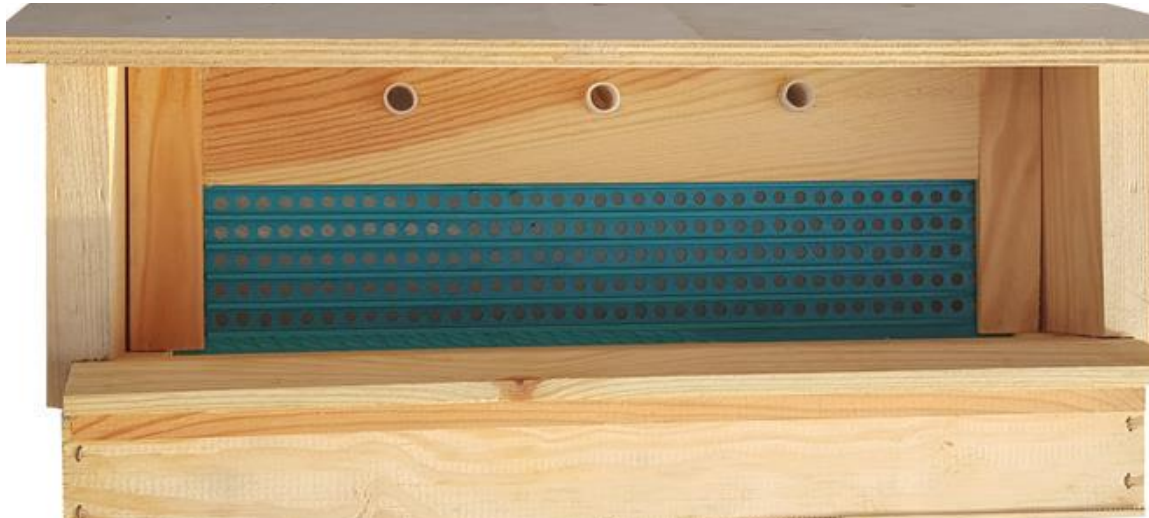


Fig 20:Pollen trap

18. **Honey jars** (glass or plastic) are materials important (used) in handling honey /extracted/ until reaching the consumer/contain 500gm/
19. **Bee-Escape board:** Bee escapes are used in removing bees from supers before it is taken from hive. It is a funnel – shaped structure on the inner board which allows the bees to go out the supper



Self-Check -1	Written Test
----------------------	---------------------

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

Part I: Matching (1pt each)

Match the following equipments under column B with their function under column A

- | | |
|---|---|
| <p>A</p> <ol style="list-style-type: none"> 1. Serve as the floor for beehives 2. Rooms for eggs and broods 3. Remove bees from super during harvesting 4. keeps queen out of super 5. Serve as weapon for beekeepers during hive operation | <p>B</p> <ol style="list-style-type: none"> A. Queen Excluder B. Hive body C. Smokers D. Beescape board E. Bottom board F. Chisel G. Honey chamber H. Frames |
|---|---|

Part II. Choice (1pt each)

Choose the correct answer from given alternatives

1. Which component of hive is the part of Kenyan top bar?
 A. Top bar B. Frame C. Super D. brood chamber
2. The beekeeper's equipments which is used for removing extra combs and propolis from frames while hive opening
 A. Smoker B. chisels C. brush D. forks

Part II. Give short answer (6pts)

1. List at least three well known transitional hives
 List at least six the main beekeepers equipments

Note: Satisfactory rating - 10 points Unsatisfactory - below 10 points

You can ask you teacher for the copy of the correct answers.



Answer Sheet

Score = _____
Rating: _____

Name: _____

Date: _____

Short Answer Question

PART I

1. -----
2. -----
3. -----
4. -----
5. -----

PART II

1. -----
2. -----

PART III

1. 2. 3.
2. -----



Information Sheet-2	Using correct manual handling techniques of loading and unloading materials
----------------------------	--

2.1. General manual handling techniques in loading and unloading materials

When loading materials care should be taken not to break and make damage the items, not to yourself. The equipments should not overcrowd, not throw away, and not mix different kind of equipments.

Everyone lifts, holds, carries, pushes and pulls on a daily basis whether it is during leisure activities or as a part of paid work. Manual material handling involves lifting light, heavy and awkward objects. Safe lifting is a critical aspect of daily activities and should be the focus of any manual material handling

Before lifting, remember the following:

- Wear supportive shoes;
- Use lift assists (hand dollies, carts, lift tables, forklifts);
- Carry all movements out horizontally (e.g., push and pull rather than lift and lower);
- Always use your body weight and not your feet when pushing;
- Try to have most workplace deliveries placed at hip height;
- Always keep objects in the comfort zone (between hip and shoulder height);
- Keep all loads close to and in front of the body;
- Keep the back aligned while lifting;
- Maintain the center of balance;
- Let the legs do the actual lifting; and
- Reduce the size of the material to keep it light, compact and safe to grasp

2.1.1. Squat lifting

Squat lifting should be done for a majority of all lifts. Squat lifting should be performed as follows:

- Stand as close to the load as possible;
- Move your feet shoulder width apart;

Animal Production level-II	October 2019, Version:01	Page 13 of 63
	Copyright Info/Author: Ethiopia Federal TVET Agency	



- Tighten your stomach muscles so you can tuck your pelvis;
- Bend at the knees, keeping your back straight and stomach tucked;
- Get a good firm grip on the load;
- Hug the load close to the center of your body;
- Lift smoothly with your legs gradually straightening the knees and hips into a standing position; and
- Avoid twisting your body as you lift.

2.1.2. Loading

- Keep the load close to the centre of your body to take full advantage of the mechanical leverage of your body;
- Do not change your grip on the load unless it is weight supported;
- Avoid twisting your body without pivoting your feet at the same time;
- If you must change direction, move your feet in that direction instead of twisting your trunk in that direction;
- Make sure you can see over the load; and
- Move carefully toward your destination

2.1.3. Unloading objects

Unloading objects should be done the same way as lifting objects, but in the reverse order as follows:

- Slowly bend your knees to lower the load;
- Keep your back straight and the weight close to the center of your body;
- Allow enough room for fingers and toes when the load is set down;
- Place the load on a bench or table by resting it on the edge and pushing it forward with your arms and body; and
- Secure the load to ensure that it will not fall, tip over, roll or block someone's way.

Animal Production level-II	October 2019, Version:01	Page 14 of 63
	Copyright Info/Author: Ethiopia Federal TVET Agency	



Self-Check -2	Written Test
----------------------	---------------------

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. What are lifting aids for lifting equipments (2pts)
2. Write the correct positioning during loading heavy materials(3pts)

Note: Satisfactory rating - 3 points

Unsatisfactory - below 3 points

You can ask you teacher for the copy of the correct answers.

Answer Sheet

Score = _____
Rating: _____

Name: _____

Date: _____

Short Answer Questions

1. -----

2. -----



Selecting, checking and using Personal Protective Equipments

Protective equipment is to protect the beekeeper from bee stings. When beekeeper working with bees, they should select well fitted clothing with no punch and preferred colour, at minimum, wear a beekeeping hat and veil, and elbow length gloves that are leather and closed heel shoes. Bees are sensitive to color So that during the daylight hours, light-coloured clothing (preferably white, yellow or green) should be worn; for night work, dark colours are better. All protective clothing must be cleaned regularly with a brush and water to remove the smell of the sting.

Personal protective equipments are:

- **Bee –veil:** It is a head veil made of mosquito- netting & is used – is the material used to protect head region, face & neck from bee’s sting. The hat is ventilated, keep its shape and be firm enough to support the veils that fit over them and provide space that keeps the away from the face.



- **Gloves:** are generally used to protect the hands and fingers against sting by bees. Gloves need to be strong, but pliable. A band of elastic should be sewn into the cloth sleeve at the elbow end to make it bee resistant.



➤ **Overall:** An overall is useful while working in an apiary to prevent the bees from going up your selves or into your garments.



➤ **Boot /foot wear:** it should be closed toe and closed heel shoes should be worn.



Self-Check -4	Written Test
----------------------	---------------------

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

3. Write the prerequisite of using protective clothing.(2pts)
4. List all protective equipment and their uses(3Pts)

Note: Satisfactory rating – 3 points

Unsatisfactory - below 3 points

You can ask you teacher for the copy of the correct answers.

Answer Sheet

Score = _____

Rating: _____

Name: _____

Date: _____

Short Answer Questions

1. -----

2. -----



Information sheet 4

Working safely around and with bees

4.1. Precautions in working with bees

The beekeeper should take into account that bees react strongly to certain smells such as perspiration, alcohol, soap and perfume.

In order not to be stung:

- Work with bees during appropriate time (early in the morning /late in the evening).
- avoid carrying these strong smells when you inspect and do with the bee colonies,
- do not keep any animals near the bees,
- avoid jerky movements in and around apiary
- Cover you head and wear clothes made of smooth fabric to prevent entangling of bees in hair and in woollen clothing.
- When bees are aggressive they will always go for dark colours first. Wear clothing of the lightest possible colour.
- Avoid fast movement and waving your hand if bees buzz at you.
- You should especially avoid banging against the hive. Even if you have been stung, first calmly put the frame back into the hive before paying attention to the stinger.

4.2. Identifying Occupational Health and Safety (OHS) Hazards

The most common hazards associated with beekeeping includes, but not limited the following:

- Allergic reaction to bee venom
- Burns the fires from use of the smoker
- Improper lifting techniques

The sting

The worker sting is a highly modified for its defensive purpose. The sting is found in the sting chamber, invisible, last segment.

Factors motivating a worker honey bee to sting

Animal Production level-II	October 2019, Version:01	Page 19 of 63
	Copyright Info/Author: Ethiopia Federal TVET Agency	



1. Genetic make up
 - ✓ Some are highly aggressive. e.g. Tropical bees
 - ✓ Some bees are highly gentle/docile/. e.g. European bees
2. Condition of time
 - ✓ when there is scarcity of forage or less nectar flow
 - ✓ During this time the bees use high venom
3. When the colony becomes queen less during this time they get exited
4. Insecticide poison, mostly organophosphate

Reactions to stings

In human reactions to stings take place on three levels

- ✓ Localized reaction
- ✓ Systematic reaction
- ✓ Anaphylactic

1. Localized reaction (normal reaction)

Normal reaction includes: some pain, redness, itching and swelling at site

2. Systematic reaction(mild to moderate reaction)

A systematic reaction generally occurs within a few minutes of stinging and it may involves persistent or spreading pain, itching or swelling, large or uncomfortable areas of pain, redness, ongoing symptoms over several days.

Anaphylactic reaction

In this reaction symptoms can occur within a seconds, and they include difficulty in

- ✓ Abdominal pain or Vomiting
- ✓ Difficult or noisy Breathing
- ✓ Swelling of tongue
- ✓ Tightness of throat
- ✓ Wheezing or persistent cough
- ✓ Hoarse voice
- ✓ Falling blood pressure that can load to loss of consciousness and death from circulatory and respiratory collapse.



Generally, one can develop some resistance to beestings the more one is stung although the reaction to stings can become shuddery acute for no apparent reason. Those who are extremely sensitive may die from a single sting.

First aid for sting

- ✓ The sting should be removed with a sharp needle or by scraping it away from the side with a knife or fingernail.
- ✓ An ice-cold compress applied after sting has been removed will relieve the pain
- ✓ Anti-histamine; may assist with persistent itching
- ✓ Adrenaline injection

In addition to these;

- ✓ Work with bees in the late or in the evening
- ✓ Avoid working bees in rainy, windy time
- ✓ Smoke under the frame and wait two minutes before opening
- ✓ While moving in the apiary, move slowly and quietly
- ✓ Avoid crashing
- ✓ Wash your protecting materials (glove, overall, etc) after three operation times.
- ✓ When bee stings develop into large swelling and rash, medical advice should be sought straight away.
- ✓ Anyone who is acutely allergic to bee sting and knows that unconsciousness may occur a few minutes after a sting, must immediately inform someone, so that they may be transported as soon as possible to a doctor or a hospital for emergency injection treatment.

Finally, any beekeeper suffering abnormal aping side effects from bee stings should give up keeping bees.

4.3. Applying OHS requirements

Apply OHS requirements in accordance with regulations/codes of practice and enterprise safety policies and procedures. It is following general guidance's of bee farm/ beekeeping

- ✓ Any person with suspected or known allergies to bee venom must seek medical advice from their primary care physician prior to participating beekeeping activities.
- ✓ Proper lifting techniques shall be used when lifting boxes

Animal Production level-II	October 2019, Version:01	Page 21 of 63
	Copyright Info/Author: Ethiopia Federal TVET Agency	



- ✓ Telephone must be on site any time participants are present
- ✓ Be aware that bees are sensitive to dark colours and odours such as perfume, dogs and diesels
- ✓ Maintain a fire extinguisher within 50 feet of the area where smoker will be used and information about training fire extinguisher may be found
- ✓ Keep the area around the hive free of combustible materials
- ✓ Using of relevant protective clothing and appropriate size
- ✓ use of tooling and equipment,
- ✓ use of fire fighting equipment, enterprise first aid e.g. for bee sting
- ✓ Following Occupational health and safety procedures designated for the task.

Any beekeeper has to follow emergency procedures on the following task:

- ✓ emergency shutdown and stopping of equipment,
- ✓ using extinguishing fires,
- ✓ First aid application and site evacuation



Self-Check -3	Written Test
----------------------	---------------------

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. What are OHS hazards associated with beekeeping?(2pts)
2. List the condition that motivate bees for sting(2Pts)
3. Identify characteristics of human blood reaction to sting (3pts)

Note: Satisfactory rating – 8 points Unsatisfactory - below 8 points

You can ask you teacher for the copy of the correct answers.

Answer Sheet

Score = _____
Rating: _____

Name: _____

Date: _____

1. -----

 2. -----

 3. -----

 4. -----

-



Instruction Sheet	Learning Guide #2
--------------------------	--------------------------

This learning guide is developed to provide you the necessary information regarding the following **content coverage** and topics –

- Following procedures and supervisor’s instructions
- Undertaking beekeeping work
- Carrying out Interactions with other staff, apiary site owners and customers

This guide will also assist you to attain the learning outcome stated in the cover page. Specifically, upon completion of this Learning Guide, **you will be able to –**

- Follow Instructions and directions provided by supervisor
- undertake Beekeeping work in a safe and environmentally appropriate manner
- Carry out Interactions with other staff, apiary site owners and customers in a positive and professional manner.

Learning Instructions:

8. Read the specific objectives of this Learning Guide.
9. Follow the instructions described in number 3 to 7.
10. Read the information written in the “Information Sheets 1, 2, 3”.in pages 1,3, and 23. Try to understand what are being discussed. Ask you teacher for assistance if you have hard time understanding them.
11. Accomplish the “Self-checks numbers” **in page 1, 21, 25-**.
12. Ask from your teacher the key to correction (key answers) or you can request your teacher to correct your work. (You are to get the key answer only after you finished answering the Self-checks).
13. If you earned a satisfactory evaluation proceed to “Information Sheet”. However, if your rating is unsatisfactory, see your teacher for further instructions or go back to Learning Activity #2.
14. If you earned a satisfactory evaluation from the “Self-check” proceed to “Operation Sheet 1,” **in page 28-37.**

Animal Production level-II	October 2019, Version:01	Page 24 of 63
	Copyright Info/Author: Ethiopia Federal TVET Agency	



Do the “LAP test” in page 39 (if you are ready)

Information Sheet-1	Following procedures and supervisor’s instructions
----------------------------	---

A Work Instruction is a detailed sequence of steps that a farmer/ an employee need to follow each time she/he performs a task. The purpose of a Work instruction is to organize steps in a logical format so that an employee can easily follow it independently.

The work instructions and written or verbal directions provided by your supervisors in beekeeping work place may be about the following:-

- Use of Standard Operating Procedure (SOP), which means a set of written instructions that document a routine or repetitive activity followed by an organization Wearing protective cloth
- Approach of beekeeping
- Taking care not discharge or put any chemicals that can harm the bees around the hive
- Always Beekeepers have to wear clean and non perfumed cloth whenever he/she come to apiary
- Applying beekeeping work OHS requirements
- Proper handling of working materials
- Proper handling and disposing of waste materials
- Applying of first aids



Self-Check -1	Written Test
----------------------	---------------------

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. What instruction and direction you expect from your the supervisor?

Note: Satisfactory rating - 3 points

Unsatisfactory - below 3 points

You can ask you teacher for the copy of the correct answers.

Answer Sheet

Score = _____
Rating: _____

Name: _____

Date: _____

Short Answer Questions

1-----



Information Sheet-2	Undertaking beekeeping work
----------------------------	------------------------------------

Beekeeping implies the manipulation of a bee colony based on some understanding of the bees. This gives great ease of management and harvesting for higher yields and better quality of honey. Beekeeping therefore can be lucrative at any level of technology, but the level should fit together with the local cultural and economic reality.

2.1. Identifying characteristics of honey Bees and types

Honeybees are social insects that live together in-group, cooperate in foraging tasks, defense and care of young.

Knowledge on the basics of honeybee biology is necessary in order to understand the nature of beekeeping and the principles of hive management. Optimum hive management can only be achieved with a good understanding of bee biology. Good beekeepers understand bees, recognize the needs of the colony, and take measures to meet those needs.

There are three castes in a honeybee colony, a queen, workers and drones. The three casts have different developmental stages and different tasks in the colony

Both the queens and workers are female in sex and developed from fertilized eggs, while the drones are male in sex and developed from unfertilized eggs. The only difference between the queens and the worker honeybees is the quality of larval diet (i.e. Royal jelly) they fed at their larval stage.



Worker bee



Each honeybee in the course of its life passes through four major stages (full metamorphic):

Egg ⇒ Larva ⇒ Pupa ⇒ Adult

The duration of developmental stages vary among colony members, there are also differences between races.

Developmental Stages & Time of Honeybee castes

Stage	Days after laying egg		
	Worker	Queen	Drone
Hatching	3	3	3
Cell capped	8	8	10
Becomes a pupa	11	10	14
Becomes an adult	20	15	23
Emerges from cell	21	16	24

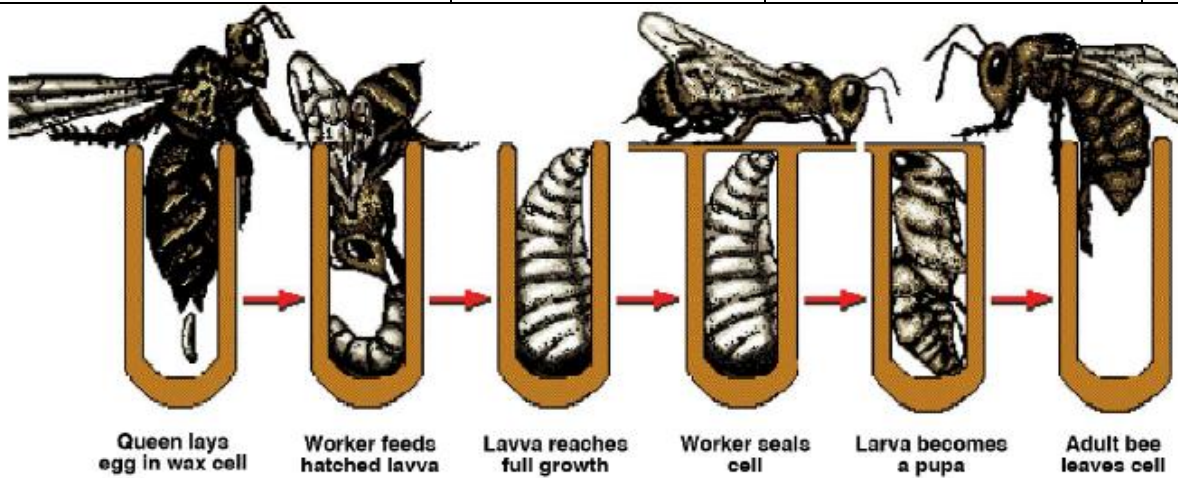


Diagram: Life cycle of honey bee

The body of honeybees is divided into three parts. These are: -

- ✓ The head



- ✓ The thorax
- ✓ The abdomen

The head is supported to the thorax by neck and the thorax is attached to the abdomen by petiole.

The head of honeybees in general seems to be triangular in shape. But its structure is differs among the members of colony. The Worker's and queens' head is slightly triangular, Drone - seems circular in its facial view. This is due to the enlarged compound eyes of the drone. This is special distinctive feature of male.

The head consists of: Eyes, Antennae/antenna, and Organs of feeding (Mandible Proboscis).

Thorax is middle portion of the body of honey bee, which contains three pairs of legs and two pairs of wings.

The abdomen is- the last segment of honeybees' body and freely attached to the thorax with the narrow petiole which contains the principal visceral organs. i.e.

- Stomach,
- Intestine,
- Reproductive organs,
- Wax gland,
- Sting and sting gland

.The abdomen has nine segments; the structure of abdomen differs among the members of the colony.

The abdomen of worker

- Broad at an anterior end
- Tapered/pointed/ toward the posterior end

The abdomen of queen

- Similar to that of worker bees
- But relatively larger and looks like cylindrical

The abdomen of drone

- More rounded at its posterior end than the posterior end

The worker sting is a highly modified for its defensive. The sting is found in the sting chamber, in visible, last segment.

Animal Production level-II	October 2019, Version:01	Page 29 of 63
	Copyright Info/Author: Ethiopia Federal TVET Agency	



2.1.1. Honey Bees races

Bees that produce enough honey to make harvesting worthwhile belong to two sub- families' honeybees (Apinae) & stingless bees (Meliponinae).

Apinae has only one genus-Apis, of which five species are economically important.

These are: -

1. Apis florea
2. Apis dorsata
3. Apis cerana/indica
4. Apis mellifera
5. Apis laboriosa

Of these five species of honeybees, A. mellifera has greatest economic importance and widely distributed all over the world.

2.1.2. Honeybee races of Ethiopian (A. mellifera races)

There are 5 honeybee races are found in the country. Those five honeybee races occupying ecologically different areas

Character and distribution of those races are as follows:

Apis mellifera monticola

- ❖ The biggest and darkest of all other races found in the country
- ❖ Found to exist in the northern high mountainous part of the country
- ❖ Has low tendency for reproductive swarming and migration
- ❖ Less aggressive than other races
- ❖ Has longest body hair than other races

Apis mellifera bandansii

- ❖ The largest honeybees next to monticola
- ❖ Found in central highlands of the country
- ❖ Dark in colour, but has few yellow members
- ❖ Has longest body hair next to monticola
- ❖ Has high tendency for reproductive swarming
- ❖ Has less migration tendency than A. m. jemenitica



- ❖ Is less aggressive than *A. m. Jemenitica*
- ❖ Give better honey yield than *A. m. jemenitica*

Apis mellifera scutellata

- ❖ Occupy the wet tropical forest lands
- ❖ It is darker than *A. m. jemenitica* & *A.m.woy-gambella*
- ❖ Its population comprises some yellow honeybees
- ❖ Has higher tendency for migration
- ❖ It exhibits aggressive to highly aggressive behaviour
- ❖ Give better yield than *A. m. jemenitica*

Apis mellifera jemenitica

- ❖ Is the yellowest honeybee but also consists black members
- ❖ Smaller than *bandansii*, *monticola* & *scutellata*
- ❖ Has less tendency for reproductive swarming
- ❖ Has high migration tendency
- ❖ Is aggressive than other races

Apis mellifera woyi-Gambella

- ❖ Found in the extreme western and southern semi-arid to sub moist low lands
- ❖ Found only in Ethiopia
- ❖ It is the smallest of all honeybee races in the world
- ❖ It has shortest hair cover
- ❖ It is predominantly yellow in colour, but also comprise black members
- ❖ Has less tendency for reproductive swarming
- ❖ Has intermediate migration behaviour
- ❖ It is aggressive to highly aggressive in behaviour

2.2. Selecting and preparing apiary site

Apiary is a place where bee colonies are kept. Successful beekeeping requires a well planned and suitably located apiary. Establishing a new site requires more investment. But it offers the opportunity for the farmer to plan and properly lay out the apiary



2.2.1. Selecting suitable Apiary Site:

Selection of a good site is one of the most important decisions in beekeeping, because beekeeping is more dependant on the natural environmental conditions than other livestock production. Ideally, the apiary is located within a 1 km radius of food sources. In addition, there should be a source of good water in the immediate area since bees need as much water as pollen and nectar, and a colony may drink up to several liters of water a day. The site should also be far enough from human settlements, livestock and agricultural activities, especially because African bees have strong protection instincts and easily attack when disturbed.

Precaution must be taken especially in areas with intensive application of chemical pesticides. The bees can be poisoned and the resulting honey contaminated

The desirable features of good apiary site:

A. Presence of native bee's colony: - It is believed in that any place, where it is suitable for bees, can be already occupied by bees. There are number of factors causing for non-existing of honeybees in an area assumed to be suitable for beekeeping. The uncontrolled application of insecticide, herbicide and fungicides have caused great catastrophe in the past and now it is becoming serious. Deforestation and predators have been the cause for the loss of so many bee colonies.

Therefore, prior to make decision for the site it is better to make survey or ask the elders for the presence of honey bees.

B. Presence natural Vegetation: The presence of natural plant habitat and cultivated crops near and around apiary is basic for the establishment of apiary (bee yard)

C. Availability of fresh water within 5km. Water is one of the most important components of honeybee diet. To satisfy the requirement of water by honey Bees River or fresh water must be available near or around the site all seasons.

D. Weather conditions

Humid and wet areas have indirect influence on the honey production because the high humidity in the area affects the quality of honey due to an increased amount of moisture content.

E. Temperature of the area:

Effect of high temperature

Honey bee combs will be melted due to high temperature and leading to colony absconding.



It will disturb brood nest temperature from normal ranges 32-34°C. This also keeps bees busy in gathering water for hive ventilation instead of nectar and this reduces honey production.

High temperature causes dehydration and death of the larvae.

Effect of low temperature

Low temperature causes chilling and death of brood. Bees could not fly in cold weather and are inactive for foraging activity. Therefore in site selection areas with frequent changes of weather leading to extreme degrees of temperature should be avoided. However areas having temperature range from 16°C to 24°C are favorable for the honeybees if all other factors required are fulfilled.

F. Topography: - The topography of an apiary site should not be swampy, floods and at top of a hills.

G. Accessible: - Whenever possible it is preferable to have an apiary site near by the road.

H. Chemical poisoning and Pollution

Chemicals such as insecticide, and herbicide sprayed on crops poisons honeybees while foraging on flowers. This may lead to death or weakening of bee colonies. Therefore the apiary site should be free from these chemicals and if the chemical spray is necessary for the crop, beekeepers should take some measures or has to negotiate with crop growers.

I. Diseases and pests of honeybees

Disease and enemies of honeybees should not be visible around an area used for apiary site selection. There are very many enemies of honeybees in tropical countries, which cause great damage both to bees and their products. Ants and honey badgers are becoming serious enemies of honeybees causing great loss

J. Apiary sites should be away from public and animals at least 100 meters and has to be fenced to keep out of reach of animals and human

Recommended distances of the apiary

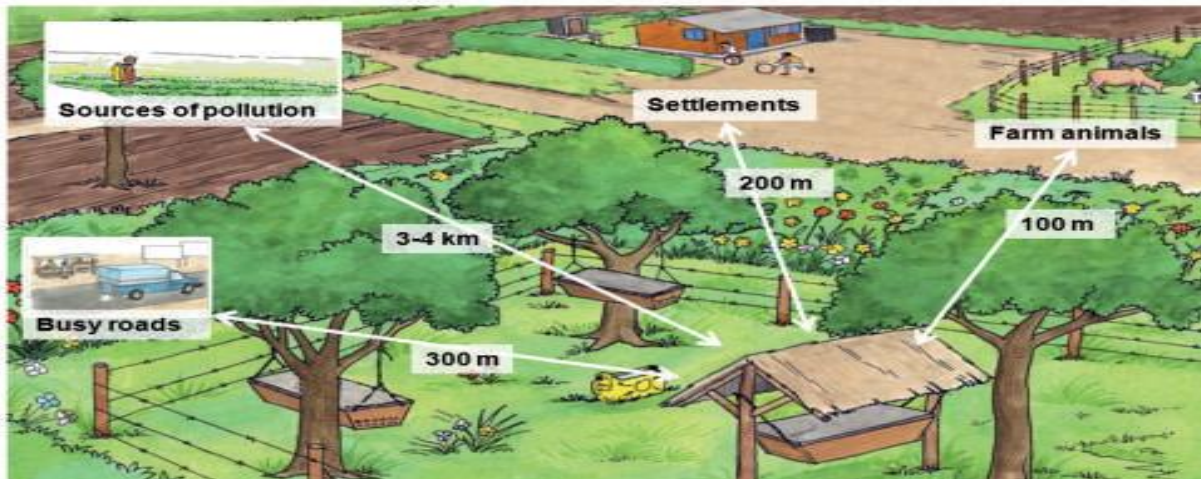


Fig2. Recommended apiary site location

2.2.2. Improvement of Apiary Site

It is not always possible to get ideal apiary sites. As long term planning it is possible to improve apiary sites by:

- ❖ cultivating and planting multipurpose trees and crops, e.g. fruit trees
- ❖ Integrating with other activities like:-
 - ✓ Conservation
 - ✓ Rehabilitation of degraded lands
 - ✓ Animal forage development and
 - ✓ Horticultural crops

2.3. Baiting hive

Bait the beehive with any one of the following materials: a little raw beeswax, dry cassava flour, a sweet syrup such as palm wine or molasses, granulated sugar, sweet-scented lavender, limes, cow-dung, intestinal waste, lemon grass or even, in very dry areas, a dish of water. The best bait is beeswax, which can quickly attract a swarm of bees. Beeswax is the most reliable bait, because it retains its properties for a long time. All other baits cannot last long in the hive and must be replenished or replaced when the old supply is exhausted or destroyed

2.4. Wiring frames



Definition: it is the process of stretching thin galvanized wire through the holes of frame, pulling tight and fastening. It is used to support honey combs in the frame i.e. prevent the curving down of combs due to weight wet and permits rapid handling and transporting long distance with little or no damage off.

2.5. Transferring bee colony

An established colony in nuclei box or in a traditional hive should be transferred to a standard movable frame hive or movable comb hive. This is because in these domiciles (dwelling place) the combs are crooked (run cross wise) or across-diagonally. As a result they cannot be managed properly and they produce only small amount of honey. Transferring honeybee colonies from fixed hives is an important method of obtaining bees in easy management situations. This is usually what transferring colony of honeybee's means.

Necessary preparations for transferring bee colonies

To undertake Transferring bee colonies the following materials should be provided

- The hive to which the colony is going to be transferred with its full components
- Smoker- to smoke the bees out. To do this smoke the upside down because
- Knife to cut the honeycombs from the original hive.
- Bee brush to guide (draw) the bees to the new home
- Big dish (bowl) to collect the cut combs and others
- Water sprayer to hinder (cool down) the bees from flying up
- Straw mat/ plain iron sheet, or canvas to save the bees from falling on the ground or in the grass.
- Frame wire, sisal rope, or rubber band etc to tie (attach) honey and brood combs to the frames top bars.
- The colony, which is going to be transferred, should be placed in its new site (place) at least three days in advance. This is very important to orient the bees to their new environment and foraging direction.
- The site (place where transferring will take place, and colony will be placed) should be cleaned
- The hive which will be used, as a new home for the colony has to be filled with wired and attached wax foundation frames/ or with wax smeared top bars.

Animal Production level-II	October 2019, Version:01	Page 35 of 63
	Copyright Info/Author: Ethiopia Federal TVET Agency	



- The smoker should be filled with fire and smoking materials at least 10 minutes in advance.
- The beekeeper must prepare his/her protective clothes dress them properly and also prepare the other necessary equipments.

Season (time) of transferring

The best season to transfer colonies of bees from one hive to the other is a period of honey flow. An ideal time is during honey bees plant bloom at the first week of active season (at the end of heavy rainy season or the end of dry season) in order that the bees could exploit the environmentally available flowering plants and build up their population.

If the transferring place is away from the reach of people and animals, it is quite possible to do the transferring during day time starting from morning to late afternoon. If the operation of transferring is near resident areas or at backyard, the possible and safe operation time is after all animals, school children and other walking living things are under their respective shelters. It is not advisable to do transferring alone. Two or more people can do better jobs and safe.

Follow up after transferring

Once the colony is transferred to the new hive the beekeeper should:

- Under take external hive inspection always against the ants attack
- Inspect the colony internally to check whether the colony started comb building
- Observe or examine for the egg laid by the queen
- Carry out the necessary hive manipulation for the building up of the colony fortnightly or once in a month.

2.6. Extracting Wax

The process by which wax from combs is converted into blocks of clean beeswax by melting is commonly called rendering. Based on the available technology, the crude beeswax can be rendered through different techniques.

- -Melting
- -Mouldings (for having specified shape and weight such as 10 Kg, 20 Kg, 25 Kg, 50 Kg)
- -Bleaching



Bee wax – is a true wax secreted by four pairs of wax glands on the ventral side of Abdomen of worker bees about two weeks



of Age & synthesized from reducing sugars of elementary organ.

Properties of wax

- Plasticity at about 32°C
- Contracts on cooling
- Insoluble in water
- Melt at about 64°C & highly inflammable (65-66.7°C)
- Readily absorb volatile chemicals

Sources Wax for processing:

- crude honey
- old combs
- capping
- Transferred colonies
- Broken pieces of combs and extracted combs
- Residues from Local brewery (tejj bet)

Whatever beeswax is to be used for, it has to be melted and cleaned. As soon as it has been melted and turned to a solid wax block, it can be stored or transported without any problems. The wax block is not eaten by wax moths

Methods of rendering Wax

There is plenty of expensive equipment available to achieve beeswax rendering. This includes stainless steel solar-wax-melters, steam-wax-melters, wax presses, wax and honey separators and electric melters. However, most beekeepers do not own such equipment and achieve excellent results without spending any money on equipment.

a. Solar extraction

It is an apparatus, which is made up of a glass cover with wood or stainless iron and a tray on which melted wax is collected. The solar wax extractor consists of a glass or clear plastic-lidded box containing a sloped sheet of metal. Pieces of honeycomb are placed on the metal sheet and as they melt, wax runs down the metal slope to a container. The sheet of metal can be bent at the edges to funnel wax towards the container. A screen of wire mesh prevents pieces of comb and debris from slipping down into the container.

Animal Production level-II	October 2019, Version:01	Page 37 of 63
	Copyright Info/Author: Ethiopia Federal TVET Agency	

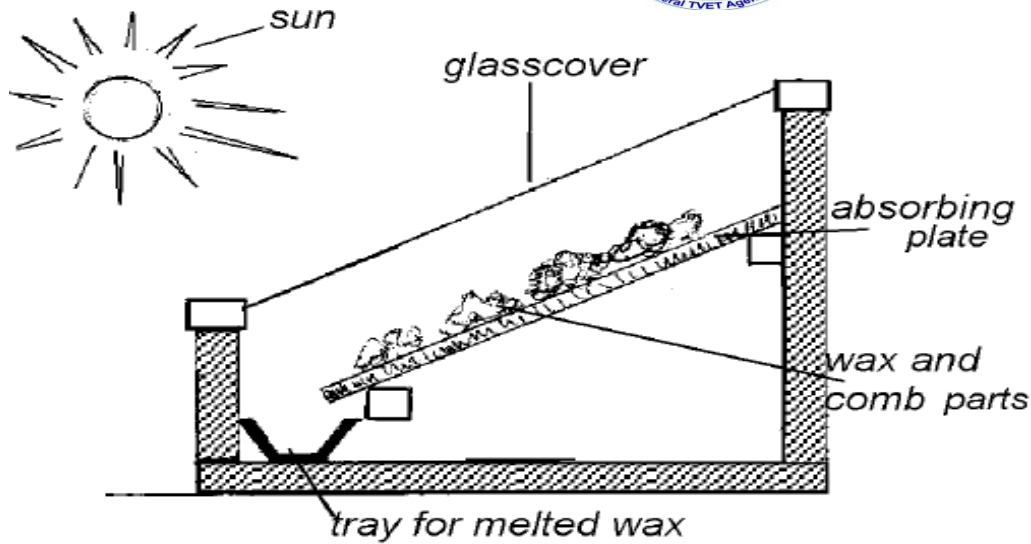


Fig 4: solar wax extracting

b. Traditional wax extraction (sack wax extraction)

Traditional method is to simply put the broken combs collected from different sources into a hessian sack and drop it into a large cooking pot full of water, with the sack weighted so that it sinks. Heat the water. Wax is lighter than water, so that as it melts, the wax will filter through the sack and rise to the surface. Once the combs have all melted, turn off the heat and leave the pot pour it into sack squeeze it then let it to cool down.

2.7. Making comb foundation sheet and Fixing to frame

A honeycomb is a mass of [hexagonalwax](#) cells built by [honey bees](#) in their [nests](#) to contain their [larvae](#) and stores of [honey](#) and [pollen](#)

Comb foundation is thin sheets of beeswax imprinted on each side with patterns of [hexagonal](#) cells. It is made by using a device known as casting mould

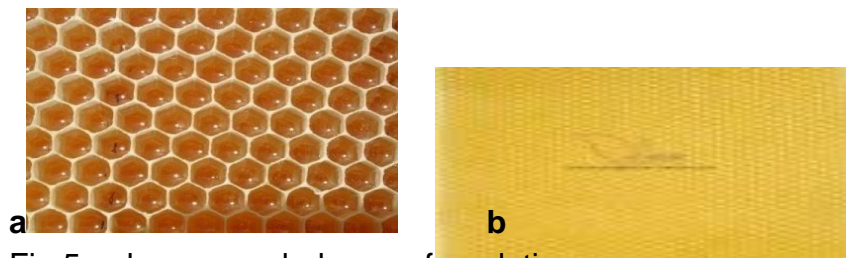


Fig 5: a-honey comb, b- com foundation

2.8. Inserting and removing queen excluder



A queen excluder is a device used above the brood chamber through which worker bees can pass, but queens and drones are excluded because of their size. Queen excluders are made of various metals or plastic.

Many beekeepers leave installed queen excluders in beehives. This is wrong and should be corrected. During flowering seasons, the queen should get enough space to lay eggs to strengthen the colony. If the queen is restricted by the excluder all the time there will be a negative impact on honey production. Hence, the installing and uninstalling of queen excluders should be determined by the seasons. The need to install queen excluders varies depending on the condition of the environment and the strength of the colony. Some beekeepers install excluders when they super. This restricts the queen from laying eggs in similar places. In hotter areas and where the flowering season is shorter, because the gap between the supering and installing excluders is short, some beekeepers carry both activities at the same time. This practice may not work in all conditions and should not be taken as an alternative practice.

Timely and properly installing queen excluders is one of the activities conducted in flowering seasons and when the colony is strong.

Time to insert queen excluder

Queen excluders have to be inserted 21-30 days before the expected honey-harvesting period to those colonies which had two boxes all season.

2.9. Increasing Beehive Size (Supering) and reducing

2.9.1. Supering

Supering is defined as the addition of hive bodies to the existing hive which contain a bee colony. As soon as flowering commences the queen starts laying eggs up to 1500-2000 a day during the flowering period. As a result the population becomes high and the population may become congested. If supering is too late the colony becomes swarmed and split due to overcrowding which brings in a reduction of population and a decrease in honey yield. If colonies split, honey harvest decreases. Increasing beehive size controls the splitting and swarming of the colony. In addition to this giving more space to colonies will give them an opportunity to lay eggs and to increase colony size and produce more honey.

If the colony in the base is overcrowded, supering at the proper time is necessary. There are indications that show when the base is overcrowded. External observations indicate a big number of bees going in and out of the beehive. In the evenings many bees cluster at the entrance of the

Animal Production level-II	October 2019, Version:01	Page 39 of 63
	Copyright Info/Author: Ethiopia Federal TVET Agency	



hive. This may indicate lack of space. Internal inspections show frames fully covered by bees. Suppering is of no use if it is off season. If the amount of honey flowers decreases the colony size will not increase

Rule and time of Suppering

- As soon as the bees are fulfilling their brood area
- As soon as the bees are working in the first super to the extent of about $\frac{3}{4}$ of its capacity a second super should be given
- Added just before (at the time) the top of the frames are whitened with fresh bees wax

2.9.2. Reducing super

This is of the dearth period colony management which depends on the strength of the colony. It is carried out

- ✓ Where the honey has been removed.
- ✓ The colony does not occupy the super i.e. because extra super harbors pests and products

During reducing supers combs with some food, new drawn combs and having work spaces should remain with bees and the old combs (dark or broken) dry (empty) combs should be reducing.

2.10. Preparing and using smoker

The smoker is an essential tool for any beekeeper. Smoke has been used to calm down the bees when handling beehives

Preparing the Smoker for Use

Steps to prepare

- Checking Weather conditions

The first step is to confirm the climatic conditions. You should check the weather details and any warning or fire bans on the radio, web or contact the weather bureau or fire service in your area.

The bee smoker should not be used in strong windy conditions as a stray spark could start serious fire.

- **Fuelling the bee smoker**

Many different fuels are used by beekeepers:

- ❖ Dried cow dung is very popular, easy to get, produce a cool smoke and are easy to put out.



- ❖ Clean Hessian (not from bags which have contained chemicals) is very popular with large commercial beekeepers as it stays alight for a long period of time. It is difficult to put out.
- ❖ Other fuels used include flaky bark from Angophoras, Stringy bark, Tea tree bark, Cypress pine, wood shavings and dry lawn clippings.

Fuels that upset bees include rags anything containing oils or chemicals, hair, paper and feathers. Any fuels used must be free from chemicals. Always collect fuel when it is available.

➤ **Lightening the smoker**

- ✓ Gently 1. Select a safe area to light the smoker so as not to set fire to the surroundings. Of course, not all areas will be as convenient.
- ✓ Open the lid of the smoker with your hive tool
- ✓ Starting to light the smoker
- ✓ Tear up a sheet of newspaper into shreds and make a loose ball.
- ✓ Light the newspaper
- ✓ Drop the burning paper into the bottom of the smoker barrel.
- ✓ puff the smoker using enough pressure on the bellows to maintain a flame

2.11. Supplementary feeding of honey bees

Providing feed to weaker colonies is one of the improved methods of beekeeping. When the dry season is longer colonies get weaker and this is the time necessary to provide them with additional feed. This will prevent absconding and death of colony due to hunger. Feed provision will enable colony to with stand the shortage period and be ready to reproduce quickly during the flowering season and this will enable to harvest good amount of honey. Feed provided to colony should be good enough to replace what they would naturally consume. Honey that they require for energy would be replaced by sugar. The pollen they use to build their body would be replaced by pulse and cereal flour.

The natural food of the honey bee consists of pollen, nectar and water. Proteins, vitamins, minerals, and fats are obtained from pollen. Pollen is essential for the production of larval food and for brood rearing in honey bee colonies. Inadequate pollen stores hinder brood rearing and the development of strong colonies. A pollen substitute is a protein source containing all the essential nutrients for bees but without pollen. The feeding frequency is determined by the severity of the shortage.

The most important feeds for honeybees are honey, sugar syrup, pollen substitute, pollen supplements, dry sugar and homemade candy

Animal Production level-II	October 2019, Version:01	Page 41 of 63
	Copyright Info/Author: Ethiopia Federal TVET Agency	



Feeding of those feed is categorized as the following based on the condition and operation manipulate with bees. Those are:

- ❖ Stimulative feeding: - Feeding of colony to stimulate the queen to lay more eggs so as to ensure much brood rearing.
- ❖ Manipulative feeding: - This type feeding is used when some particular hive operation is carried out such as queen rearing, inspection, uniting etc. If the bees are fed either before or after the operation they are guided to the special manipulation
- ❖ Supplementary/ emergency / feeding: - At certain time pollen shortage can retard colony development. During such time sugar syrup or honey would not materially improve the condition the honeybees must have a supply of pollen or pollen substitute readily available to restore the depletion of food in the hive

The types and constitutes of feed is categorized according to the operation carrying out. These feeds can be placed either out of or inside the hive.

2.12. Honey harvesting and extracting

2.12.1. Honey harvesting

The honey crop is his reward for a year's hard work and imaginative planning. Beginners always ask the question" when to harvest honey, the answer is when it is ripened. When the honey is ripe the bees cap it with a thin layer of beeswax. Thus, any capped or sealed honeycombs may be removed from the hive. Ripened honey is the end product of the long process during which the nectar of plants undergo chemical changes and also losses considerable moisture.

Honey can be considered as ripe when 75% the comb is sealed

What are indications for honey harvesting?

- There is strong aroma of honey smelling
- Clustered bees around the entrance
- Bees become ideal/less traffic at entrance
- Consider the colander of the area from the previous observation
- Finally open & check ripe & sealed honeycombs

Early cropping is important

To force the bees to collect 2nd round honey either for their Owen or for 2nd harvest

Animal Production level-II	October 2019, Version:01	Page 42 of 63
	Copyright Info/Author: Ethiopia Federal TVET Agency	



The hive is opened in the appropriate manner. After the inner cover is removed, the honey super is assessed by visual examination of the frames, to see that it is at least three quarters sealed and thus ready for removal. Smoke is blown down between the frames. Then the super is lifted a few centimetres at front or back, and allowed to drop back into position. Then, when most of the bees are out of the super, the honey combs will be taken off. In such manner, the honey frames will be harvested and brought to honey house.

It may avoid the consumption of the store by the bees particularly if there is rain

If harvesting is at late flowering leave some provision to the bees.

Or if you remove all the honey immediately feed them with sugar

After harvest- extract & strain the honey while it is liquid

Uncapping the honeycombs and extracting honey

After the honey combs with frames are brought to the honey house, the sealed honey combs should be uncapped in order to be extracted easily, to let the easy flow of honey from the comb cells. There are many types of uncapping equipments available for commercial operator, from steam and electrically heated to mechanically operated units. In our country, uncapping fork is now commonly used. Uncapped honey will be extracted by the manually or electrically operated centrifugal honey extractor. There are many types of honey extract developed with various capacity of frame holding.

Extraction of honey

Extraction is removing of honey from a comb. It should take place as soon as honey comb is harvested. Equipments & place used for extraction should be clean and dry. The frames in each batch of extraction should be relatively balanced. During extraction, the extractor should be kept close to prevent the losses of volatile substances, which are important for flavor and aroma of honey.

Animal Production level-II	October 2019, Version:01	Page 43 of 63
	Copyright Info/Author: Ethiopia Federal TVET Agency	



Self-Check -2	Written Test
----------------------	---------------------

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

I. Choose the correct Answer from the given alternatives

1. Among honey cast which is develop from unfertilized egg?
A. Queen B. worker C. Drone
2. Which races of A.m. is found only in Ethiopia
A. A.m. adansoni
B. A. m. woyi –Gambela ,
C. A.m. scutelleta
D. A.m monticola.
3. The material used for making foundation sheet is
A. Casting mould
B. solar max extractor
C. Embader
D. transformer

II. Write short answer for the following question

1. Write desirable feature for selecting good apiary site.(5pts)
2. How can you improve your apiary site?(2pts)

Note: Satisfactory rating - 5 points

Unsatisfactory - below 5 points
Answer Sheet

You can ask you teacher for the copy of the correct answers.

Score = _____

Rating: _____



Name: _____

Date: _____

Short Answer Questions

Part I

1. -----
2. -----
3. -----

Part II

1. -----

2. -----



Information Sheet-3	Interacting with other staff, apiary site owners and customers
----------------------------	---

Interacting with other staff, apiary site owners and customers in a positive and professional manner

Any beekeeper has to have the ability to work or interact with other employees or his coworker because it is an important job skill that employers need their employee to hand. The traits included are: -

- ✓ Develop and maintain a pleasant personality and have patience with other workers.
- ✓ Work with other to achieve the common goals of the company.
- ✓ Good social skills, such as the ability to meet and talk with people may be an important job
- ✓ Understand appropriate relationships on the job both worker to peer- and worker- to-supervisor.
- ✓ One must be careful not create a hostile or intimidating work environment nor to harass other workers.
- ✓ Jokes that may be offensive to some people or that make fun of ethnic groups, religions, genders, sexual presences or minorities are not appropriate in the work place.
- ✓ Avoid vulgar and profane language.
- ✓ Believe on the equality of man and woman on the job.
- ✓ Do not make sexual advances to another worker, subordinate, or supervisor.
- ✓ Do not become involved in disputes between other workers.

A **customer** is any person who had, has or can have some interaction with your farm and your professions. The “customer” can include final consumers, any member of an organizational buying center of your products

Building good relationships with this customers and apiary site owner is essential develop trust. So interaction is building workplace integrity to foster the development of high professional standards, and demonstrates the value of the organization professionally. Integrity involves ethical leadership, active management and supervision, the right people, effective processes and confident professional reporting. An ethical and professional workplace is the best safeguard against risks to integrity, including improper conduct, misconduct. Professional interaction entails a host of factors that beekeepers must pay particular attention to.

Animal Production level-II	October 2019, Version:01	Page 46 of 63
	Copyright Info/Author: Ethiopia Federal TVET Agency	



Self-Check - 3	Written Test
-----------------------	---------------------

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. Define customer (2pts)
2. What are your professional traits as beekeeper?(3)
3. What is interaction (2pts)

Note: Satisfactory rating - 5 points

Unsatisfactory - below 5 points

You can ask you teacher for the copy of the correct answers.

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions

1. -----

2. -----

3. -----



Operation Sheet 1	Constructing Ethio- Ribrib hive
--------------------------	--

Material and equipment requirements

It requires at least the following local and industrial materials for construction:

1. Eucalyptus of 4-5 cm diameter or any other suitable wooden poles and nails
2. Queen excluder and plywood
3. Hollow bamboo, plastic cover sheet, wire and rope

It has the recommended guideline steps to construct which is recommended by IRLI and

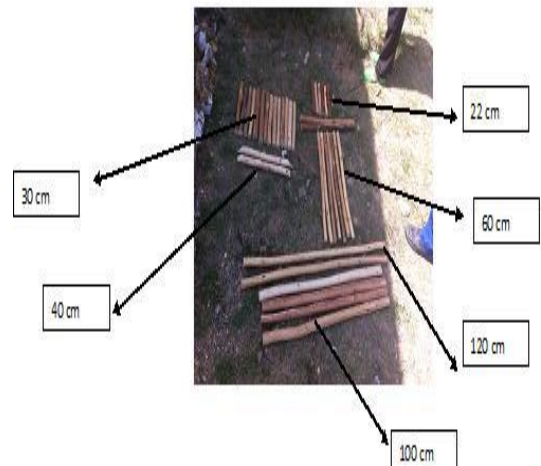
Ethiopian agricultural researchers

Step #1: Cutting wooden materials

Cutting eucalyptus into six different lengths

The required lengths and quantities of eucalyptus/other trees poles include

- Two pieces of 120 cm long: used as the long side of hive cover
- Four pieces of 100 cm long: used as top and bottom length of hive
- Seven pieces of 60 cm long: used as the short side (width) of hive cover
- Two pieces of 40 cm long: used as top width of hive
- Fourteen pieces of 30 cm long: used as vertical frames/raisers
- Six pieces of 22 cm long: used as bottom width frame



Step #2: Assembling

- Join piece of cut poles using appropriate size nails. The gap between the vertical stands is 10, 25, and 30 cm

Animal Production level-II	October 2019, Version:01	Page 48 of 63
	Copyright Info/Author: Ethiopia Federal TVET Agency	

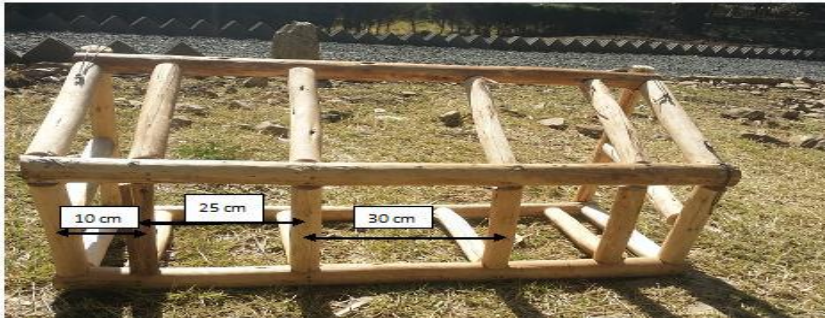


Fig6: Attached eucalypts pole

Once the wooden pole are joined, the dissected hollow bamboo is wave on the five side and bottom poles. The bamboo which is waved on the pole should dissect vertically up to 3cm diameters.

Step #3: Mud plastering and creating a grove for inserting queen excluder/plywood



The inner side of the assembled hive should be plastered using mud composed of loam soil and fine straw, and slowly dried under shade(see figure 4.7). It is advisable to finish the plastering using cow dung and rub the inner side using plants preferred by bees.

Step #4: Constructing hive cover and making frames

The hive cover is made from eucalyptus poles, intact bamboo and plastic or iron cover sheets and is 120 cm long and 60 cm wide. The top bar to which the comb is attached should made from up to 22 thick hollow bamboos or other wooden materials

Fig 8: Top bar





Operation Sheet-2	Frame Wiring
--------------------------	---------------------

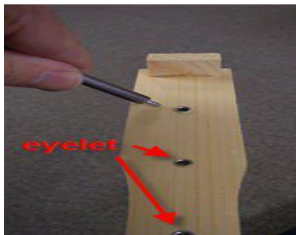
Techniques for frame wiring:

Required Material and equipment

Driller, frame, wire, nails, needle nose pliers, hammer

Steps of wiring

Directions for Wiring Frames

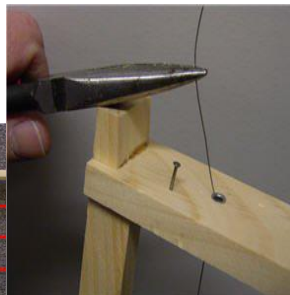
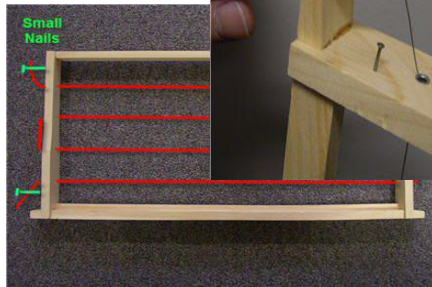


1. Drilling frames by drill to make eyelets in the sidebar

2. Insert metal eyelets into each of the holes in the sidebars. This prevents the taut wire from cutting into the wood.

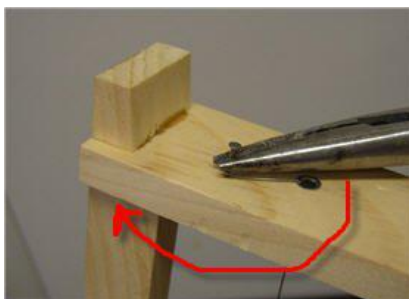
eyelets in the following

4. At each end of the wire drive side bar. Now nail. With one pliers to pull way to do this with needle the frame as



3. Weave a piece of wire through the pattern:
a 1" nail (medium) partially into the wrap one end of the wire around a end secured use your needle nose the other end of the wire taut. One is to get a grip on the loose end nose pliers and using a corner of fulcrum, pry the wire taut.

5. Wrap the end of the wire around the other nail head. You should be able to hear a low note if you strum the wire in the frame. You can get a little more tension by turning the nail like tuning a guitar with your needle nose pliers.



6. Hammer the two nails flat into the side bar to secure the wire. On the inside of the side bar bend over the protruding nails, so they are flat and out of the way. Trim any tails of the wire or else later on when you are



removing a frame from the hive you will get stuck by the wire and think you were stung.

Operation Sheet 3	Sack Wax extraction
--------------------------	----------------------------

Materials and equipments

Impure collected max, cooking pot, stirrer, ladle, sack or strainer

Procedures

The steps in the process of rendering the beeswax under this method are:

1. Prepare all necessary equipments
2. Collect the impure waxes from different sources
3. Firing fire / plug stove to socket
4. Put on cooking pots on fire or on stove
5. Pour water first into pot to prevent burning of wax
6. Melt the crude beeswax/comb in melting pot with water or a vessel having water jacket.

Excessive heat discolors the beeswax



wax cakes floating on top of the water

7. The melted material will be placed in sack and squeezed under a pot with cold water where the clean beeswax is collected
8. Use sticks to squeeze the hot wax
9. Cover the container containing cold water and melted wax and leave it till next morning in order to get solid



Processing the wax

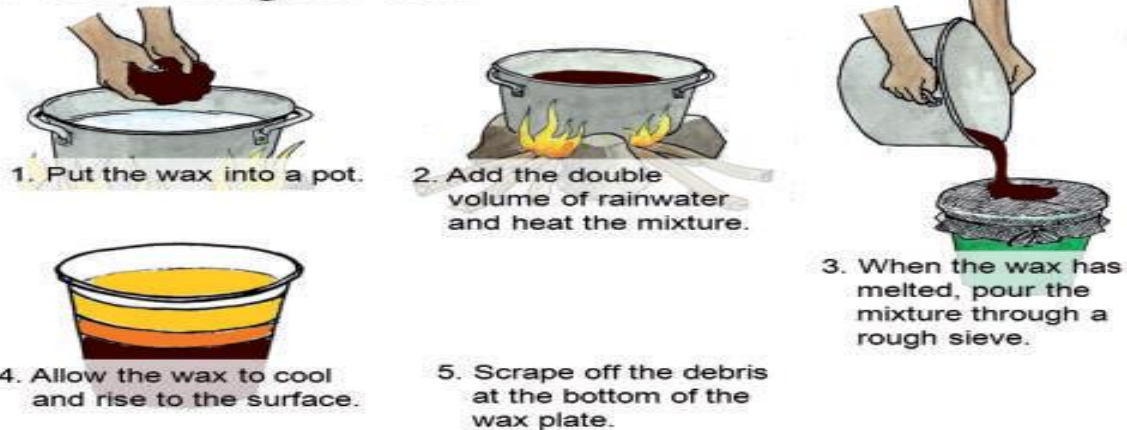


Fig 11: steps of wax rendering process

Operation Sheet 4	Printing wax comb foundation sheet
--------------------------	---

Material Required

- ✓ Double boiler (e.g. a bowl floating in a pan of water) in which to melt the beeswax.
- ✓ Mug or ladle for pouring molten beeswax (do not use copper, brass, or iron - These discolor and harm wax) (A plastic mug or jug is inexpensive and does not cool the wax too much).
- ✓ Knife or Pizza Cutter to cut around the template.
- ✓ Release agent (e.g. fresh water with a drop of liquid detergent two or three percent of alcohol (5cc),homo and a spoonful of honey and/or a dash of lemon or lime juice may also be added if required).

Preparing casting mould for use

To prepare the mould before using:-

- Pour very small cupful of liquid detergent (washing up liquid) on to each part of the mould.
- Scrub very gently with small nylon brush all over both mould plates and the wooden surround.
- Rinse off the detergent using release agent.

Animal Production level-II	October 2019, Version:01	Page 52 of 63
	Copyright Info/Author: Ethiopia Federal TVET Agency	



Steps to Make wax comb Foundation

1. Pour in approximately 500 ml of release agent to thoroughly wet both mould plates and the wooden surround.
2. Close the mould to ensure even wetting. Then open a little and pour the release agent back into its storage pot.
3. Before the release agent dries pour in the molten beeswax to cover base of mould. Close lid of mould quickly, but gently.
4. Pour the excess wax back into wax pot.
5. Leave the mould until the wax has cooled to a firm, but cheesy solid - (perhaps one to two minutes is suggested, but I find 30 seconds is enough.)
6. Open the mould. The solid sheet should stick to one side of the mould - usually the top.
7. Trim the excess wax from the two sides and top (using a blunt knife). Use the bottom edge to pull the sheet away from the mould (start at one corner).
8. Discard and re-melt the first few uneven sheets (caused by the mould warming up to the optimum operating temperature).
9. Allow the fresh sheet to cool for two to three minutes (for most of the shrinkage to take place). Place the foundation on a flat surface. Then using the template and knife (or pizza cutter), cut the sheet to the size required. Off cuts and unsatisfactory sheets can be returned to the molten wax reservoir (this helps to maintain the melt at just the melting point of the wax).

If the wax sticks to the mould:

- Pour on cold release agent to loosen wax.
- If still sticking, pour hot (not boiling) rain water over the wax to melt it away. Scrub with a small nylon brush and liquid detergent to remove remaining wax. Use a sharpened wooden stick to pick off small pieces of wax.
- Never use sharp tools or a wire brush to clean this mould

NB: Take care - beeswax is flammable. Never place beeswax on direct heat (e.g. open fire, gas stove, boiling ring etc.) always use a double boiler or water bath

Steps to fix foundation sheet to frame

Animal Production level-II	October 2019, Version:01	Page 53 of 63
	Copyright Info/Author: Ethiopia Federal TVET Agency	



Operation Sheet-5	Fixing comb foundation sheet
--------------------------	-------------------------------------

Material

required

Board or metal sheet template, Knife or Pizza Cutter, embader (transformer), printed wax comb foundation, table

Steps to fix foundation sheet to frame

- Place your pre-wired hive frame flat on the work table in front of you
- Insert Wax Foundation: Place Wax sheet foundation into hive frame (Make sure the foundation inserted into the frame's grooved top bar)
- Plug in your 12V Transformer (if you use transformer): Making sure that the + and - contacts are not touching each other. Take the positive lead in one hand and the negative lead in the other and touch the foundation wire next to the end bars of the frame. Hold the leads in place just long enough to heat the wire which will start melting the foundation as it heats up (Do Not over Heat the Wire as it will cut through the wax foundation cutting it into).
- Once you see the wire starting to disappear into the wax foundation remove one lead



Operation sheet -6	Transferring colony from local Frame hive
---------------------------	--

Preparing preconditioning activities.

These include:

- a. The bees in the local hive should be placed on the spot where permanently designed to place the colony after transfer. Keep the bees in the old nest for at least three days.
- b. Fencing the apiary site is very important prior to the establishment in areas where predators are existing.
- c. Prepare wax comb foundation sheets and fix it to frame.
- d. Cleaning box hive and arranging frames
- e. Preparation of transferring site for temporary use

Materials required during transferring

The following important lists of materials are properly arranged and ready for use during the transfer and to be placed at transferring site.

- Frame hive in which new colony put,
- ready smoker and the materials to smoke,
- Bee brush,
- Water sprayer (but not critical),
- Bee hive chisel, Knife,
- Collection pan, a sort of carpet, mat, or any other flat material to be placed on the transferring ground.
- Wagon for transporting unused materials
- Wire or rope
- Queen cage
- Feeder frame with sugar paste
- Needle and rope
- Complete technician protective materials

Transferring procedures of bee colony from local hive into frame hive

Animal Production level-II	October 2019, Version:01	Page 55 of 63
	Copyright Info/Author: Ethiopia Federal TVET Agency	



1. Put the mat or flat material prepared on the transferring ground
2. Prepare the smoker with smoking materials inside and place near the edge of the mat
3. Put bee brush near by
4. Have water sprayer with water, good if you make it available
5. Bring the new nesting frame hive and place it on the mat having the size of 120 to 130 cm
6. Open the cover(lid) of the frame hive
7. The entrance of the frame hive should be towards the wider areas of the mat.
8. While bringing the old hived colony, do not roll or change the original position of the hive. Keep its position as it was until reaching the transferring place
9. Hold local hive in the inclined position
10. Put the new nesting frame hive near and on operation mat.
11. The transferring has to be conducted with a steady and gentle manner of operation. This is mostly to avoid the magnitude of committing error in damaging the queen bee and minimizing jerking movement during removing combs from old nest.
12. The operation would start by opening the local hive lid.
13. Smoke around the edge of the hive soon after opening the lid. It helps to clear or move away the bees from working areas.
14. Whenever removing combs look for the queen bee on both sides of the comb and place it where appropriate. The brood and the honey comb are to be placed separately
15. Use bee brush now just to clear the bees from the combs removed.
16. If the queen bee is discovered by chance soon after the operation started, then catch the queen bee and put her in a cage and place her in the new frame hive. Then continue the operation. However, this time on wards, there is nothing to worry about the mood of working
17. At any time of operation after the queen is caught place her in queen cage and then put her in the new nesting frame hive.
18. Cover the frame hive now after placing the queen bee in
19. During the operation if the queen bee is not discovered immediately, the work should continue but in a gentle manner until no comb is left in the old hive.



20. During the operation in cooperation with other people, fix brood combs removed from old nest on frames of frame hive with the appropriate head position of the removed combs correctly upward. Use rope and needle to tie brood combs on frame
21. When everything from the local hive is removed, hold the local hive with both hands up and forcefully knock down on the mat so that all the bees inside the old hive would fall, then search for the queen bee carefully.
22. Make sure that no bees are left in the old local hive. Then take away the old local hive from the working site.
23. Allow the bees or indicate the direction of the hive entrance to run to where the queen bee is. Most of the time worker bees would search and reach her quickly.
24. There are rare incidences missing the queen bee during transferring. She may go with the swarm bees in to the new frame hive unseen or she may be out of the working areas resting on technicians' body or on tree branches or on other places. If its wings were clipped, it may fall down on the ground. If the queen bee is not in the new nesting hive, the worker bees are reluctant to join her going to the new hive. Even after the transferring has been successfully conducted, it is essential to check the remaining situation. So sometimes watch carefully to exploit the unexpected situations. It is possible to find two queens while transferring.
25. After completion of the transfer, place the new frame hive with the newly transferred bees in place of the old hive.
26. Finally clean working areas and materials that were used during the transfer



Operation sheet -7	Supering and Reducing
---------------------------	------------------------------

**Material
required**

- Complete frame box with fixed comb foundation
- Complete protective cloth
- Smoker
- Bee brush
- Chisels

Procedures

1. Inspect the colony which need supering at flowering stage
2. Prepare necessary equipments and hive boxes to be added
3. Smoke to the colony by standing at a side or back
4. Take off the lid from the hive by chisel
5. Take out 3-4 frames which contain eggs and young larvae from the existing box and place it in the newly added box to familiarize the bees to the new box
6. Replace new comb foundation frame instead it in the existing box
7. Put the new box on existing box and cove it.



LAP Test -1	Practical Demonstration
--------------------	--------------------------------

Name: _____

_____ Date: _____

Time started: _____ Time finished: _____

Instructions: Given necessary templates, tools and materials you are required to perform the following tasks within **4** hours.

Task 1: Extract wax by sack method

Task 2: Prepare comb foundation sheet

Task 3: Fix prepared comb foundation sheet to frame

Task 4: Perform supering



Instruction Sheet	Learning Guide #3
--------------------------	--------------------------

This learning guide is developed to provide you the necessary information regarding the following **content coverage** and topics –

- Handling of waste material
- Handling and transporting of materials, tools and equipment
- Returning or dispose materials
- Cleaning , maintaining and storing tools and equipment
- Reporting work outcomes and difficulties in completing

This guide will also assist you to attain the learning outcome stated in the cover page. Specifically, upon completion of this Learning Guide, you will be able to –

- Handle waste material produced during work
- Handle and transport materials, tools and equipment
- Returning to Store or dispose materials
- Clean, maintain and store tools and equipment
- Report work outcomes and difficulties in completing

Learning Instructions:

15. Read the specific objectives of this Learning Guide.

16. Follow the instructions described in number 3 to 7

17. Read the information written in the “Information Sheets 1, 2, 3, 4” in pages 1, 3, 5 and 7. Respectively. Try to understand what are being discussed. Ask you teacher for assistance if you have hard time understanding them.

18. Accomplish the “Self-checks1,2 and 3” in page 2,4,5 and 8 respectively

Animal Production level-II	October 2019, Version:01	Page 60 of 63
	Copyright Info/Author: Ethiopia Federal TVET Agency	



19. Ask from your teacher the key to correction (key answers) or you can request your teacher to correct your work. (You are to get the key answer only after you finished answering the Self-checks).
20. If you earned a satisfactory evaluation proceed to “Information Sheets”. However, if your rating is unsatisfactory, see your teacher for further instructions or go back to Learning Activity #3.
21. Submit your accomplished Self-check. This will form part of your training portfolio



Information Sheet-1	Handling Waste material
----------------------------	--------------------------------

A waste is a material that is no longer needed, wanted or used. There are different waste materials or product which will be produced in work place but the main waste material which will produced at the apiary site are the following:

- ❖ Broken components
- ❖ Plant debris
- ❖ Plastic
- ❖ News papers
- ❖ Metal and paper-based
- ❖ Comb attacked by wax moth
- ❖ Dead broad

Waste minimization is a process that involves reducing the amount of waste produced in the farm.

. There are different ways of avoiding those waste materials from our apiary site.

- The first way is recycling that waste material in a usable form. For example that of dead bees, plant debris and newspapers used as production of organic fertilizer.
- The second way is returning waste material such as old iron, thin, metal and plastic to manufacturers.

The third way is re using waste material. E.g. broken combs and impure waxes as input for wax production and foundation sheet production



References

- Web address: www.abelo.co.uk
- Web address: www.accreditedfirstaid.com.au
- Beekeeping manual 1: The Life of the Bee (© Pam Gregory. 2011)
- Belets Gebremichael and Berhanu Gebremedhin, 2014. Adoption of improved box hive technology: Analysis of smallholder farmers in Northern Ethiopia. *International Journal of agriculture and extension*, vol 2(2), pp.077-082
- Brian Rowe, 2009. Beekeeping manual. 310 Milltown Road, Bridgewater, NJ 08807-3587
Buddy Marterre (n.d) Basic Beekeeping Technique
- David Cramp, 2008. A practical manual of bee keeping. Spring Hill House, Spring Hill Road Begbroke, Oxford OX5 1RX, United Kingdom
- FiBL (2011): Organic Beekeeping. African Organic Agriculture Training Manual. Version 1.0 June 2011. Edited by Gilles Weidmann and Lukas Kilcher. Research Institute of Organic Agriculture FiBL, Frick . ISBN 978-3-03736-197-9
- Harlan H.D Attfield, 2001. A Beekeeping Guide for the Tropics and Sub Tropics
- Holeta Bee Research Center, 2004. Beekeeping training manual. Holeta, Ethiopia.
- Tom Chester in , 2014. Equipment list for beginning Beekeepers. Oregon master beekeeper
- Ayalew Kasaye et al., 2011. Advanced Beekeeping Manual. Ethiopian beekeepers association, addis abebe.
- Amssalu, B., Nuru, A., Radloff, S.E., Hepburn, H.R., 2004. Multivariate morphometric analysis of honeybees (*Apis mellifera*) in the Ethiopian region. *Apidologie* 35, 71–81.
- Ministry of Agriculture, Animal Industry and Fisheries, 2012. National Bee keeping training and extension manual. Uganda.
- Yetimwork Gebremeskel, 2015. Characterization of Beekeeping Systems and Honey Value Chain, and Effects of Storage Containers and Durations on Physico-Chemical Properties of Honey in Kilte Awlaelo District, Eastern Tigray, Ethiopia

Animal Production level-II	October 2019, Version:01	Page 63 of 63
	Copyright Info/Author: Ethiopia Federal TVET Agency	

