

Animal Production

LevelII

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standard**



Module Title: - : Carrying outBeekeeping Operations

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Introduction to the Module

This module covers the knowledge, skills and attitude required to carry out beekeeping operation. Among all the first learning outcome requires the ability to prepare for beekeeping work. Under this learning outcome many important contents are illustrated, such as what are the required materials, tools and equipment, how to check and conduct on all materials, tools and equipment, correcting manual handling techniques are used when loading and unloading materials to minimize damage, the selection of Suitable **PPE, OHS** requirements.

The second learning outcome is focused on undertake beekeeping work. Under this learning outcome so many important contents also covered regarding to enterprise requirements. How to undertake beekeeping work in a safe and environmentally appropriate manner, the necessary instructions, directions, clarification provided by supervisor, how to create well interactions with other staff, apiary site owners and customers are carried out in a positive and professional manner and reporting timeline problems or difficulties in completing work.

The third learning outcome cover more valuable contents under the most identified plant and honey bee flora for providing nectar and pollen is carried out according to industry requirements. Confirming the common bee floral calendar in to appropriate beekeeping operations, assessing basic nutritional need of honey bee depending on industry requirements, identifying the conditions and situations that affecting plants for honey bees productivities.

The final learning outcome summarizes about manner of waste disposal, handling, clean and transporting of material, tools and equipments. Under this topic so many typical points are listed according to industry requirements. In general the module cover and give valuable information about work outcomes, difficulties in completing work, reported to supervisor, feedback, and any required improvements are noted for future action.

LG #29

LO #1-Prepare for beekeeping work

Instruction sheet

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

- Identifying materials, tools and equipment
- Checking and reporting all materials, tools and equipment
- Using correct manual handling techniques
- Selecting and checking suitable **PPE**
- Providing work support to **OHS** requirements

This guide will also assist you to attain the learning outcomes 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 below.
3. Read the information written in the information Sheets
4. Accomplish the Self-checks
5. Perform Operation Sheets
6. Do the “LAP test”

Information Sheet 1

1.1 Identifying materials, tools and equipment

1.1.1. Definition of terminologies

Beekeeping-also referred to as Apiculture is the art and science of maintaining honeybees in a manmade domicile for the purpose of harnessing their products and services.

The honey bee;- is one of our best known insects, whose relationship with humans can be traced back to the dawn of humankind when early people ‘stole’ honey from wild bee nests. The most common honeybee products are honey and beeswax, but honeybees also produce propolis, bee venom, pollen and royal jelly.

Honey and pollen- are food but mainly honeybee products are used in food, cosmetics or pharmaceutical industries. The importance of honeybees however goes beyond their use as food or industrial inputs. Honeybees and beekeeping contribute to peoples’ livelihoods as they benefit society by increasing household food, income and ecosystems maintenance through pollination.

Honey - a sweet viscid material produced by bees from the nectar of flowers, composed largely of a mixture of glucose and fructose sugars dissolved in 15–19 percent water; contains small amounts of sucrose, mineral matter, vitamins, proteins, and enzymes.

Apiary - an area where colonies of bees, and perhaps other beekeeping equipment, are located; also called bee yard.

Apiculture -the science and art of keeping honey bees.

Hive- a human-made home for bees.

Equipment needs vary with the size of your operation, number of colonies, and the type of honey you plan to produce. The basic equipment you need are the components of the hive, protective gear, smoker and hive tool, and the equipment you need for handling the honey crop.

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.

- The common materials, tools and equipment, used for beekeeping operation are the following;
 - Hives
 - Queen excluder
 - Casting mold
 - Bee brush
 - Grafting tools/needles
 - Honey extractor
 - Wax
 - Honey presser
 - Wax extractors
 - Chisels
 - Bee smokers
 - Frame wire
 - Weighing scale
 - Frame grip
 - Water sprayer
 - First aid kits
 - Sack
 - Grinder
 - Fork
 - Bin card
 - Rack
 - Queen cage
 - Embedder/ electrical and manual knife
 - Queen cell cup
 - feeder frame
 - Detergent
 - Bowl
 - Pollen trap
 - Honey tank
 - Uncapping fork
 - Bucket
 - Honey jar
 - Cleaning equipment
 - Spade
 - Shovel
 - Wheel barrow

1.1.2. Beehive

Bee hive is the man-made structure in which the honey bee colony lives.

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.



Figure 1.1. Local/Traditional hive

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)



Figure 1.2 Transitional hive

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. Over the years a wide variety of hives have been developed. Today most modern beekeepers use the Langstroth or modern ten-frame hive. The bee space is **5-6 mm** for most *Apis mellifera* species of African bees.

Components of modern hive

Beehive - a box or receptacle with movable frames, used for housing a colony of bees.

Hive stand - a structure that supports the hive.

Bottom Board- the floor of a beehive; usually includes colony entry/exit.

Brood chamber- the part of the hive in which the brood is reared; consists of one or more hive bodies and the combs within.

In addition; inner Cover, Telescoping cover (outer cover), supers (may be added as needed)



Figure 1.3 Components of modernhive

Queen excluder- metal or plastic device with spaces that permit the passage of workers but restrict the movement of drones and queens to a specific part of the hive.

Frame - four pieces of wood/plastic (top bar, a bottom bar, and two end bars) designed to hold foundation/drawn comb.

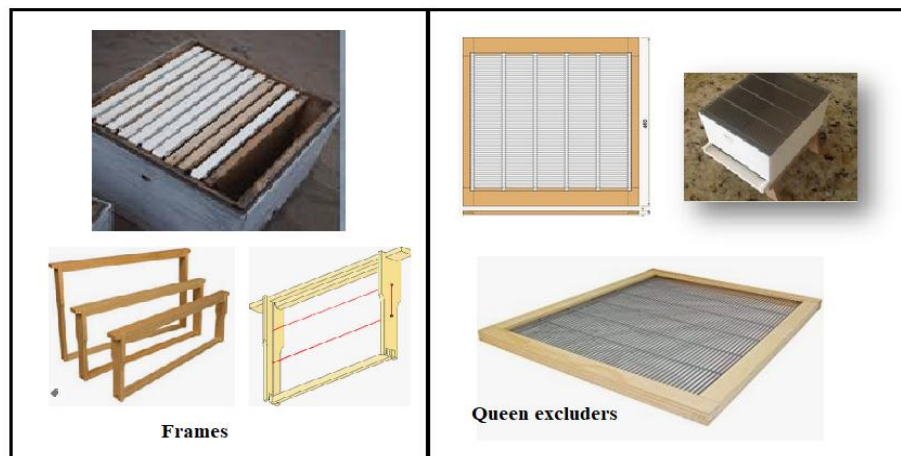


Figure 1.4 Frame and Queen excluder

1.1.3. Other beekeeping tools and equipments beyond to modern hive

Grafting tool - a needle or probe used for transferring larvae in grafting of queen cells.

Honey extractor - a machine that removes honey from the comb cells by centrifugal force.

Smoker- a device in which burlap, wood shavings, or other slow-burning materials are used to produce smoke that is used to subdue bees.

Bee brush - a brush used to remove bees from combs.

Casting mould - 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.

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.



Figure 1.5 Tools and equipments for beekeeping work

Solar wax extractor-a glass-covered insulated box used to melt wax from combs and cappings using the heat of the sun.

Honey presser: It is used to extract honey by method of hand pressing of honeycombs, which are not framed.

Uncapping fork/ knife : Is a material used to de cap the cells of sealed honeycomb before the frame combs are placed in the honey extractor

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.

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.

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



Figure 1.6 Materials and tools used for beekeeping work

Electric embedder - a device allowing rapid embedding of wires in foundation with electrically.

Queen Cell Cup- is used to confuse worker bees so that they accept it as if naturally made cups. It is not a complete cell cup produced.

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.

A frame grip - is a useful tool, especially when working the bees alone. Frame grips allow the beekeeper to pick up the frame with one hand, leaving the other hand free and make picking up heavy frames easier.

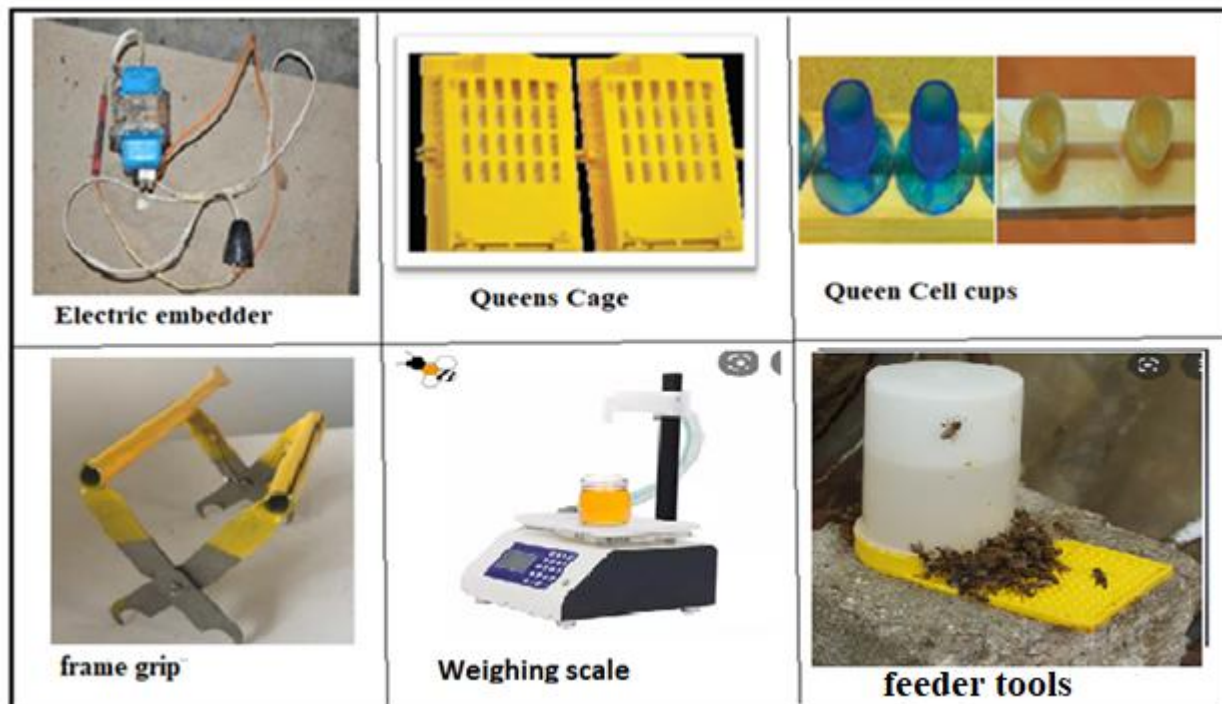


Figure 1.7 Different tools used for beekeeping operation

<https://www.youtube.com/watch?v=rCcggQoIK-Q> /access date 05/09/ 2022

1.2. Checking and reporting all materials, tools and equipment

Checks should be conducted on all materials, tools and equipments before, during and after work to the supervisor for the presence of all materials as well as for their functionality and availability to purchase in market.

1.2.1 Definition of defective/faulty and non defective tools

- **Defective /faulty tools** can cause serious and painful injuries. If a tool is defective or faulty in some way, don't use it.
- Be aware of problems like: chisels and wedges with mushroomed heads, tools which are not complete, such as files without handles.
- Functional tools and equipment are those that are in good condition and can perform its regular functions.
- Lockout–tag out (LOTO) is a safety procedure used in industry and beekeeping activities to ensure that dangerous machines are properly shut off and not able to be started up again prior to the completion of maintenance or repair work.
- If a tool is defective, remove it from service and tag it clearly out of service for repair. Replace damaged tools immediately and do not use it as a temporary.

1.2.2. Characteristics of a non defective tools

- **Non defective tool-** tools that are not broken or at perfect condition.

Visual Inspection- The defective and non-defective tools are easily identified through visual inspection. Defective and non-defective tools are described by its physical appearance such as dullness, sharpness, dismantled parts and more.

Inspections reveal problems early, when they're still relatively easy and inexpensive to fix. Improperly working equipment isn't used and damaged even more. Using inspection records, maintenance managers can identify and correct repeated problems and issues.

The use of defective equipment can lead to a range of head and body injuries, including injuries to the eyes and face. Electrical equipment that does not come with proper insulation can cause electrocution, burns, and electric shock. Defective equipment can often lead to construction accidents.

Watch for problems like: broken or inoperative guards, insufficient or improper grounding due to damage on double insulated tools.

1.3. Using correct manual handling techniques

1.3.1 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.

1.3.1.1. 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

1.3.1.2. 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.

Before lifting, remember the following:

- 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

1.4. Selecting and checking suitable Personal Protective Equipments /PPE

1.4.1. Protective clothing for beekeeping operation

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.

- Some of personal protective equipments used for beekeeping operation are;

A) Bee veil

Bee veil 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.

Three basic types of veils are available: those that are open at the top to fit over a hat, completely hatless veils, and veils that form part of a bee suit. A wire or fabric veil that stands out away

from the face worn over a widebrim, lightweight hat that fits securely offers the best protection. Veils without hats, although lightweight and fold easily for transport, do not always fit as securely on the head as they should. The elastic band that fits around your head often works upward, allowing the veil to fall against your face and scalp as you bend over to work with bees.

B) Overall

An overall is useful while working in an apiary to prevent the bees from going up your selves or into your garments. Coveralls or shirtveils (long-sleeved shirts) made especially for beekeepers with attached, removable veils are popular. White or tan clothing is most suitable when working bees. Other colors are acceptable, but bees react unfavorably to dark colors.

C) Hand gloves

Hand 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.

Beginners who fear being stung should wear canvas or leather gloves. Many experienced beekeepers find gloves cumbersome and decide to risk a few stings for the sake of easier handling. You should avoid using after-shave lotions, perfumes, and colognes when working with bees because such odors may attract curious bees. Regularly launder clothing and gloves used in inspection to eliminate sting/hive odors that might attract/irritate bees.

D) **Boot /foot wear**- it should be closed toe and closed heel shoes should be worn.



Figure1.8 Personal protective cloths used for beekeeping operation

1.5. Providing work support to OHS requirements

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.

1.5.1 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

1.5.1.1 The sting

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

I) Factors motivating a worker honey bee to sting

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

II) Reactions to stings

In human reactions to stings take place on three levels

- Localized reaction
- Systematic reaction
- Anaphylactic

a) Localized reaction (normal reaction)

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

b) 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.

C) 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.

III) 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
- 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 1	Written test
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Name..... ID..... Date.....

Directions: Answer all the questions listed below.

Test I: Choose the best answer

- One of the following hive type is made from locally available materials and used for trapping bees from wild (5points)
 - Modern hove
 - Traditional hive
 - Transitional hive
 - Frame hive
- One is the personal protective cloths, used to protect head region, face and neck from bee's sting (5points)
 - Overall
 - Sunhat
 - Bee veil
 - Boots

Test II: Short Answer Questions

- What is honey bee? (2points)
- What is beekeeping? (2points)
- List at least five tools and equipments used for beekeeping operation? (4points)
- Write the difference between modern and traditional hive? (2point)

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

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

Operation Sheet -1

1.1 Procedure of constructing Ethiopian transitional hive

A. Tools and equipments

1. Eucalyptus (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
4. mud or soil , water, cow dung

B. Steps of constructing local transitional hive

1. Cut wooden materials or eucalyptus into six different lengths
 - The required lengths and quantities of eucalyptus/other trees poles includes
 - ✓ 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
2. Assemble or Join piece of cut poles using appropriate size nails.

The gap between the vertical stands is 10, 25, and 30 cm like the following figure.



Figures 1. 9ab: Construction of transitional hive

3. Start mud plastering and creating a groove for inserting queen just like the following figure.
4. Construct the hive cover and making frame top bars.
 - The top bar to which the comb is attached should be made from up to 22 thick hollow bamboos or other wooden materials.

1.2 Techniques for frame wiring

A. Tools and equipments

- Driller,
- frame,
- wire,
- nails,
- needle nose
- pliers, hammer
- Pinsa
- PPE

B. Steps of performing frame wire

1. Wear PPE
2. Drill frame by drilling to make eyelet in the side bar
3. Insert metal eyelets into each of the holes in the sidebars.
4. Weave a piece of wire through the eyelets in the following pattern
5. Insert At each end of the wire drive a 1” nail (medium) partially into the side bar
6. Wrap the end of the wire around the other nail head.
7. Hammer the two nails flat into the side bar to secure the wire.

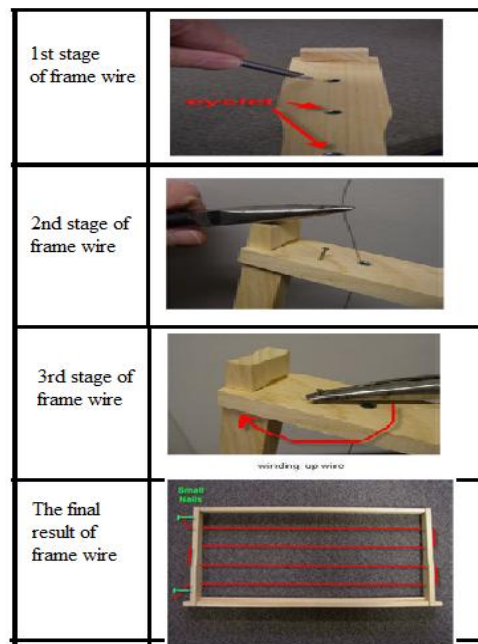


Figure1.10: Steps of frame wire construction

1.3. Procedure of preparing the beesmoker to use

A) materials and tools

- Smoker
- PPE
- Dry cowdung
- Clean Hessian
- fuels used include
 - ✓ flaky bark from Angophoras,
 - ✓ Stringy bark,
 - ✓ Tea tree bark,
 - ✓ Cypress pine,
 - ✓ wood shavings and
 - ✓ dry lawn clippings.

B) Steps of preparing the beesmoker to use

1. Wear appropriate PPE
2. Check Weather conditions
3. Fill and Fuel the bee smoker
4. Lightening the smoker
 - a) Select a safe area to light the smoker so as not to set fire to the surroundings.
 - b) Open the lid of the smoker with your hive tool
 - c) Starting to light the smoker
 - d) Tear up a sheet of newspaper into shreds and make a loose ball.
 - e) Light the newspaper
 - f) Drop the burning paper into the bottom of the smoker barrel.
 - g) puff the smoker using enough pressure on the bellows to maintain a flame

LAP TEST-1	Performance Test
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Name..... ID.....

Date.....

Time started: _____ Time finished: _____

Instructions: Given necessary templates, tools and materials you are required to perform the following tasks within **1:30** hour for each task. The project is expected from each student to do it.

Task- 1. Perform and construct Ethiopian transitional hive.

Task- 2. Perform frame wiring techniques and procedures.

Task -3. Perform preparing the bee smoker to use

LG #30

LO #2- Undertake beekeeping work

Instruction sheet

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

- Following instructions and directions
- Undertaking beekeeping work
- Carrying out interactions with stockholders
- Reporting problems or difficulties

This guide will also assist you to attain the learning outcomes 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.
- Report problems or difficulties after completing work to required standards or timelines to supervisor.

Learning Instructions:

1. Read the specific objectives of this Learning Guide.
2. Follow the instructions described below.
3. Read the information written in the information Sheets
4. Accomplish the Self-checks
5. Perform Operation Sheets
6. Do the “LAP test”

Information Sheet 2

2.1. Following instructions and directions

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
- Applying of first aids
- Proper handling and disposing of waste materials

All employees should be given adequate information, training, instruction and supervision in respect of all matters affecting their health and safety at work. Workers must receive adequate instruction and allotment of time for safe handling of all agricultural chemicals and hygienic practices. Adequate reference to this needs to be included in the written safety policy statement, beekeeping and honey bee product quality assurance program (FPQAP), enterprise policies and procedures, manufacturer instructions ,material safety data ;sheets (MSDS), OHS standards and procedures, Specifications, standard operating procedures (SOP), verbal directions from manager or supervisor work instructions and standards, work notes.

In addition to general operational training, specific training standards and competency certificates exist and will normally be necessary for operators of fork-lift trucks and boat operators in accordance with national standards.

2.2. Under taking 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.

2.2.1 Starting with bees

There are several different ways of getting started in beekeeping: buying package bees; purchasing a nucleus (nuc) colony; buying established colonies; collecting swarms; and taking bees out of tree and/ or wall cavities. We recommend novices start with either a package(s) or nucleus colony(ies). However, you should be careful when purchasing nucs (and established colonies) because you might be buying other beekeepers' problems such as disease or nonstandard equipment. Collecting swarms and transferring bees is more difficult and not recommended for the beginner without the assistance of a more experienced beekeeper. The best time to start with bees is in the spring or early summer.

2.2.2. 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. The best location for an apiary is on the side of a hill that slopes to the east or south and is devoid of trees in the immediate vicinity that might shade the location. While trees for a windbreak are helpful, they should not be too close to the site. A building, house, or garage with a flat roof is an excellent location for your hives and one reason beekeeping is such a good fit in urban areas. Even if you aren't a rooftop beekeeper, raising your hives at least 18 inches off the ground will keep your bees out of the reach of most skunks.

2.2.2.1. 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 apiary site should be rich in bee flora which may provide forage for most parts of the year and in addition there should be good density of honey flow sources near the apiary site.

<https://www.youtube.com/watch?v=3eMLJue-8DI> /access date 05/ 09/ 2022/

2.2.2.2. 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

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. The availability of water should be within 5km distance to save time workers bees.

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. 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.

E. 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.

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

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

J. 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.

2.2.2.3. 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

<https://www.youtube.com/watch?v=7I5r1qaAhQ8> /access date 05/ 09/ 2022/

<https://www.youtube.com/watch?v=p-EGno3UCZA> /accessed date 05/09/ 2020/

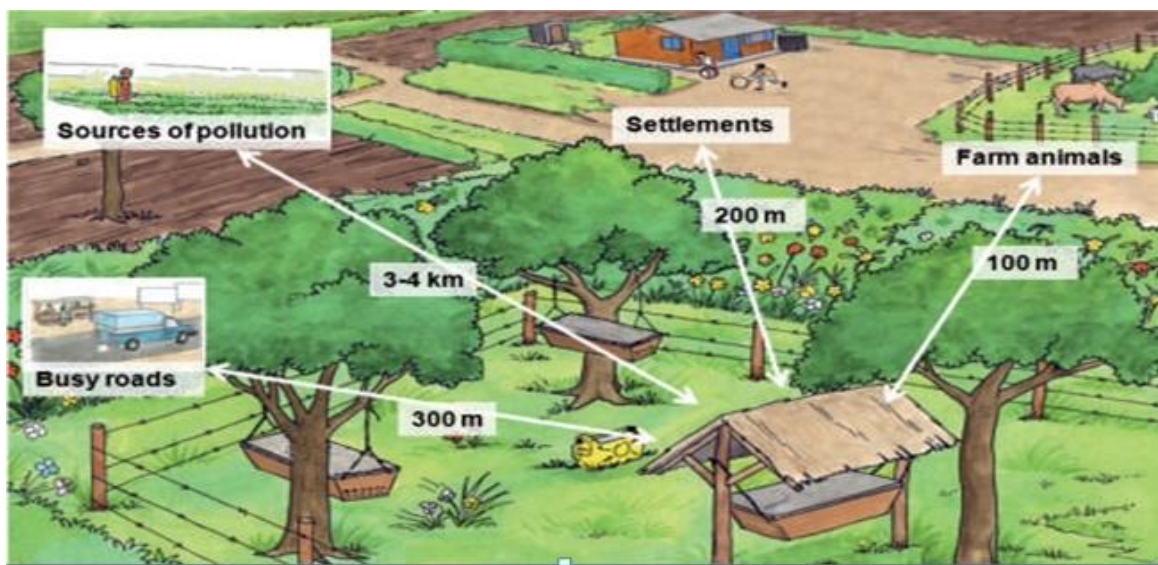


Figure 2.1 Recommended distance of improved apiary site

2.2.3. 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 permutes rapid handling and transporting long distance with title or no damage off.

2.2.4. Wax processing

Bee wax- is true wax secreted by four pairs of wax glands on the ventral side of abdomen of worker bees, about two weeks of age and synthesized from reducing sugars of elementary organ.

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

2.2.4.1. 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

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.

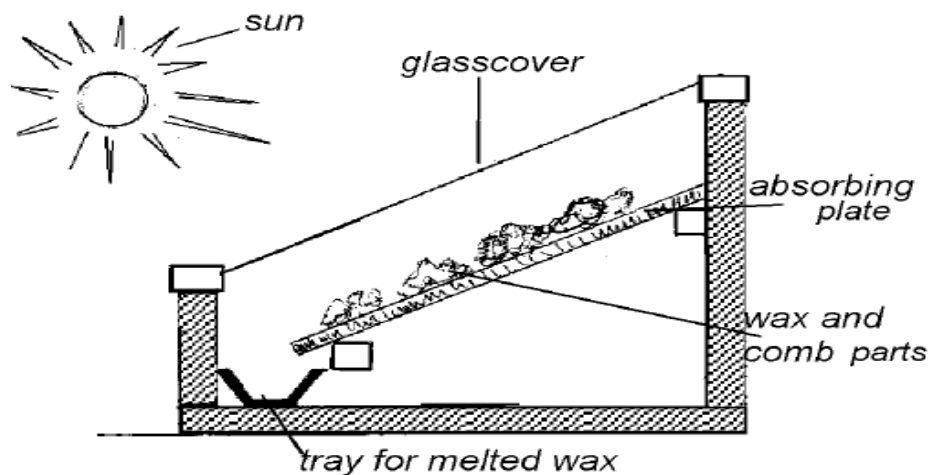


Figure2.2 Solar wax extraction

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.

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

2.2.4.2. Attractive baiting material

- A bait hive is a hive, usually with some drawn comb that is set up to attract a swarm during the swarming season.
- Bait hives are an easy and inexpensive means of obtaining honey bees to start a new hive. Captured bee swarms might be used for increasing.
- Bees are especially attracted by **beeswax** so plenty of beeswax should be used to bait the hives. Using a fresh starter strip of beeswax on the top-bars of a movable comb hive will act as a swarm attractant.

2.3. Carrying out interactions with stakeholders

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.

2.4. Reporting problems or difficulties

- Problems or difficulties in completing work to required standards or timelines are reported to supervisor.
- Any problems or difficulties which will happen while we are accomplishing our farming activities have to be reported to supervisor or manager by the required standards or timelines.
- But before reporting we have to do our best to control the problems.

Some of the important parameters used to report problems or difficulties

- The place, time and location of the farm
- The name and job title of person injured in the incident
- Name of witness
- A brief description of the incident
- An event which preceded the incident

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- Possible measures/recommendations/ to reduce similar incidents
- Name of a person who investigated the incident

Self-Check – 2	Written test
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Name..... ID..... Date.....

Directions: Answer all the questions listed below.

Test I: Multiple choice

1. All of the following are the properties of wax: except; (3points)
 - A. Plasticity at about 32°C
 - B. Contracts on cooling
 - C. Soluble in water
 - D. Readily absorb volatile chemicals
2. One of the following is not methods of rendering wax;(3points)
 - A. Sack wax extraction
 - B. Traditional wax extraction
 - C. Solar wax extraction
 - D. Contract on cooling

Test I: Short Answer Questions

1. List the desirable features of good apiary site. (3points)
2. What are the raw materials and ingredients used for sources of wax processing.2(points)
3. List the important parameters used to report problems or difficulties.(3points)

Note: Satisfactory rating - 7 points Unsatisfactory - below 7 points

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

Operation Sheet -2

2.1 Methods of printing wax comb foundation sheet

A. Tools and equipments

- Double boiler
- Plastic mug or ladle
- Knife
- Release agent (e.g. fresh water with a drop of liquid detergent two)
- Casting mold
- PPE

B. Steps of preparation foundation sheet

1. Wear appropriate PPE
2. Pour in approximately 500 ml of release agent to thoroughly wet both mould plates and the wooden surround.
3. Close the mould to ensure even wetting. Then open a little and pour the release agent back into its storage pot.
4. Before the release agent dries pour in the molten beeswax to cover base of mould. Close lid of mould quickly, but gently.
5. Pour the excess wax back into wax pot.
6. 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.)
7. Open the mould.
8. Trim the excess wax from the two sides and top (using a blunt knife).
9. Discard and re-melt the first few uneven sheets (caused by the mould warming up to the optimum operating temperature).
10. Allow the fresh sheet to cool for two to three minutes (for most of the shrinkage to take place).
11. Place the foundation on a flat surface.
12. Cut the sheet to the size required.

2.2. Techniques of fixing foundation sheet to frame

A. Tools and equipments

- Embedders,
- Knife,
- Printed wax,
- Comb foundation,
- Table,
- Boards of metal sheet template,
- Frame with wire
- PPE

B. Steps of fixing foundation sheet to frame

1. Wear PPE
2. Place your pre-wired hive frame flat on the work table in front of you
3. Insert wax sheet foundation into hive frame (Make sure the foundation inserted into the frame's grooved top bar)
4. Plug in your 12V Transformer (if you use transformer): Making sure that the + and - contacts are not touching each other.
5. Once you see the wire starting to disappear into the wax foundation remove one lead

2.3. Techniques of sack wax extraction

A. Tools and equipments

- | | |
|------|-----------------------|
| I. | Impure collected max, |
| II. | cooking pot, |
| III. | stirrer, |
| IV. | ladle, |
| V. | sack or strainer |
| VI. | PPE |

B. Steps of rendering the wax

1. Wear PPE
2. Prepare all necessary equipments
3. Collect the impure waxes from different sources
4. Firing fire / plug stove to socket
5. Put on cooking pots on fire or on stove
6. Pour water first into pot to prevent burning of wax
7. Melt the crude beeswax/comb in melting pot with water or a vessel having water jacket. Excessive heat discolors the beeswax
8. The melted material will be placed in sack and squeezed under a pot with cold water where the clean beeswax is collected
9. Use sticks to squeeze the hot wax
10. Cover the container containing cold water and melted wax and leave it till next morning in order to get solid wax cakes floating on top of the water.

Processing the wax

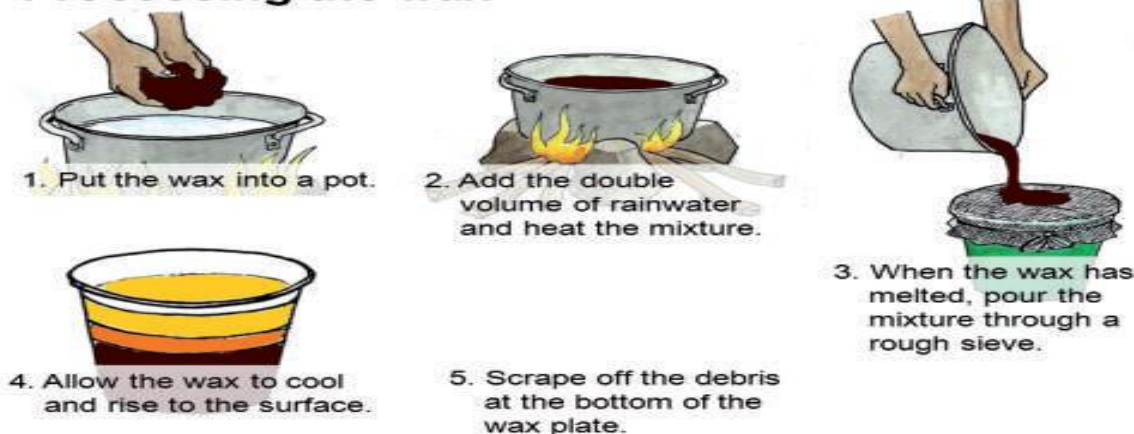


Figure2.3 Steps of wax preparation

LAP TEST-2	Performance Test
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Name..... ID.....

Date.....

Time started: _____ Time finished: _____

Instructions: Given necessary templates, tools and materials you are required to perform the following tasks within **1:30** hour for each task. The project is expected from each student to do it.

Task 1: Perform sackwax extraction activities

Task 2: Prepare comb foundation sheet

Task 3: Fix prepared comb foundation sheet to frame

LG #31	LO #3- Identify and plant honey bee flora
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Instruction sheet

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

- Carrying out identification of honeybee flora
- Confirming bee floral calendar
- Assessing a basic nutritional need of honey bee
- Identifying conditions affecting plants for honey bee

This guide will also assist you to attain the learning outcomes stated in the cover page. Specifically, upon completion of this learning guide, you will be able to:

- Identify honeybee flora for providing nectar and pollen is carried out according to industry requirements.
- Confirm bee floral calendar in to appropriate beekeeping operations
- Assess a basic nutritional need of honey bee as required by industry requirements.
- Identify conditions affecting plants for honey bees

Learning Instructions:

1. Read the specific objectives of this Learning Guide.
2. Follow the instructions described below.
3. Read the information written in the information Sheets
4. Accomplish the Self-checks
5. Perform Operation Sheets
6. Do the “LAP test”

Information Sheet- 3

3.1 Carrying out identification of honeybee flora

- Honey production and colony development are directly related to floral sources in the immediate area of your apiary.
- Major nectar flows (sometimes termed honey flows) depend on a few plant species that yield nectar abundantly and are readily available. Besides the two or three main annual sources, there should be a great variety of minor plants yielding both pollen and nectar throughout the season to support the colonies between the main flows.
- Large acreages of flowering plants are needed for bees to produce surplus honey. Planting crops just for their nectar and pollen yields is not usually economical. An acre of blooming plants rarely provides surplus honey for more than one or two colonies of bees. The value of land not being used for other purposes can be increased, if it is planted to some nectar-yielding plant such as sweet clover rather than left to grass and weeds.
- Beekeepers should become familiar with the major floral sources of their area and when these species bloom. From the standpoint of honey production, the most populous colonies produce the most honey. Thus, the essence of spring management is the development of strong colonies. Efficient management requires proper timing of colony development so that maximum populations will coincide with major nectar flows.

Table3.1. Some common source of honey bee flora

No.	Common name of honey bee flora	Scientific name	Value as a nectar source	Value as a pollen source
1	Yellow sweet clover	Melilotusofficinalis	Major	major
2	Sunflower	Helianthus spp	Minor	Minor
3	Alfalfa	Medicago sativa	Major	-
4	White sweet clover	Melilotus alba	Major	Major
5	Fruit bloom (apple)		Minor	Minor
6	Corn (field, sweet)	Zea mays	-	major
7	Soybean	Glycine max	Major	Major

8	Dandelion	Taraxacumofficinale	major	Major
9	Strawberry	Fragariaananassa	minor	Minor
10	Vetch	Vicia spp.	Minor	-
11	Adeyabeba	Guizotiascabra,	Major	Major
12	Mech/ maget	Scabraspp,	major	Major
13	Yellow gerawa	/VernoniaSpp	major	-
14	Papaya	Carica papaya	-	Minor
15	Acacia species /Girara	Acacia brevispica	major	Major
16	Coffee /Buna	Coffeaarabica	Minor	Minor
17	Eucalyptus	Eucalyptus citrodora	Minor	Minor

Honeybee plants are those plant species that provide bees with food sources in the form of nectar and pollen. Not all bee plants are equally important to bees and honey production.

Some supply both nectar and pollen abundantly and others provide nectar or pollen only

Flowering plants and their flowering duration differ from one place to other due to variation in topography, climate and other cultural and farming practices.

The extensive knowledge on type, density and quality of bee flora resources enable beekeepers to utilize the resources at the maximum level, so that, they can harvest a good yield of honey and other honeybee products in addition to effective pollination which enhances crop yields.

Ethiopia is endowed with natural and cultivated flora and diverse agro-ecological and climatic condition that are well-suited for beekeeping.



Figure 3.4. Common honey bee flora /sunflower

Ethiopia that has great diversity of flowering plants species comprises forest trees, bushes, grasses and cultivated flowering plants that are potentially useful for beekeeping. In order to boost the production from this huge resource of the bee flora of zone, identification and documentation of economic bee forages and their flowering calendar is critical for increasing the honey production.

Hence, identifying the availability of major honeybee forage species and their flowering calendar in different agroecological zone of the area is a very to know the frequency of honey harvest and to predict the honey flow period of an area to be applied in various beekeeping operation.

The nectar source plants can be identified from honey pollen analysis in addition to direct observation and surveying.

<https://www.youtube.com/watch?v=Qka-AioaCiw> /access date 05/09/ 2020/



Figure 3.5. Identification and source of honey bee flora

3.2 Confirming bee floral calendar

- The bees are dependent on flowering plants as they provide food in the form of pollen and nectar. Similarly, plants are also depending on bees for pollination.
- This mutual interdependence of insects and plants increased their coevolution.
- The flowering plants of many plant families are blooming at different time periods and seasons of the year.
- Pollen and nectar availability to foraging bees varied with time of the season and flowering periods of different plants species. The blooming period does not commence simultaneously in all the bee flora attending in the main honey-flow season.
- Climatic factors, soil parameters, habitat of vegetation, the time of blooming may change even in the same nectar plant.
- Seasonal availability of honeybee plants Knowledge of honeybee plants, proper understanding of mutualism between honeybees and available plant species is very important to improve the productivity of beekeeping.
- In rural area experienced beekeepers also familiar with honeybee plants that give good honey, when they bloom and for how long they remain in blooming.
- Some beekeepers are always paying attention to monitor the herbaceous plants, shrubs and trees that are especially important for honeybees
- Variation in seasonal availability of honeybee forage species was observed in Ethiopia and many of them are flowered from September to November and March to May.
- In many part of the country, herbaceous honeybee forage species were the dominant honey source plants in September to November due to disturbances and expansion of agricultural crops.
- However, in March to May majority of honey source plants were trees and shrubs in comparison to herbaceous.
- The high scarcity of honeybee forage will observed in July to mid of August and mid of February to mid of March.

- When honeybee plant identification is conducted as major and minor honeybee plants in honey pollen analysis, the main problem was that a given honeybee plant is major in one district and minor in the other districts. This is due to variation in the abundance of the species.

Table3.2. Some common honeybee flora and floral calendar in vegetable crops

Nb	Common name	Botanical name	Family	Flowering period
1	Tomato	Lycopersicon esculentum	Vegetable	July-September
2	Chilli	Capsicum sp.	Vegetable	July-February
3	Beans	Phaseolus vulgaris	Vegetable	Dec-February
4	Water melon	Citrullus lanatus	Vegetable	July-August
5	Onion	Allium cepa	Vegetable	Jun-August
6	Pea	Pisum sativum	Vegetable	August-September

Table3.3 Honeybee flora and floral calendar in fruit crops

Nb	Common name	Botanical name	Family	Flowering period
1	Citrus	Citrus limon	Rutaceae	Oct – Jan and July – Sep.
2	Mango	Mangifera indica	Anacardiaceae	Dec- Jan
3	Custard apple	Annona squamosa	Annonaceae	Aug – Oct
4	Papaya	Carica papaya		May- Jun
5	Water melon	Citrullus lanatus	Cucurbitaceae	Sep- Oct
6	Banana	Musa sp.	Musaceae	Jan-Dec
7	Rose apple	Syzygium jambos	Myrtaceae	Mar-Jun

Table 3.4 Honeybee flora and floral calendar field crops

Nb	Common name	Botanical name	Family	Flowering period
1	Sunflower	Helianthus annuus	Field crop	March – April.
2	Chickpea	Cicerarietinum	Field crop	Dec-March
3	Ground nut	Arachishypogaea	Field crop	July-Oct
4	Pigeon pea	Cajanuscajan	Field crop	July-Oct
5	Sesame	Sesamumindicum	Field crop	July-Aug
6	Maize	Zea mays	Field crop	Aug-Sep
7	Lab lab	-	Field crop	Jan-Dec
8	Cotton	Gossipium spp.	Field crop	Sep-Jan
9	Cow pea	Vignaspp	Field crop	Jan-Dec

3.3 Assessing a basic nutritional need of honey bee

The honey bee (*Apis mellifera*) collects a number of substances to ensure its survival. Honey bee nutrition is principally concerned with the quality and quantity of nectar and pollen collected and stored.

3.3.1 Substitutes and supplement feeds

To stimulate brood rearing, beekeepers have a choice: they can either move hives onto breeding conditions prior to major honey flows, taking advantage of various flowering species, or they can artificially stimulate their hives with supplementary feeding. This is largely an economic decision as there are costs associated with both moving bees and feeding substitutes and supplements.

The term ‘**supplements**’ suggests that there is already some naturally occurring pollen and/or nectar in the area for the bees and the beekeeper is making up the shortfall by feeding the hive strategic supplements.

Supplements should contain the nutritional components that are deficient in the field as well as make up the required volume a colony may consume. ‘Substitutes’ suggests that either nectar or

pollen, or both, are completely deficient in the field. Honey or nectar substitutes are usually in the form of sugar, preferably as sugar syrup. Large quantities of thick syrup are suitable for feeding to bees to store for winter, whereas small quantities of thin syrup fed regularly stimulates the colony to expand the brood area. If the purpose is to stimulate the colony and increase population numbers, then attention to the protein components of the diet is also essential.

3.3.1.1. Carbohydrate supplements

If a colony is critically short of stored honey or requires stimulation, feeding sugar syrup to hives will either keep the hive alive (as in winter) or stimulate the colony to rear more brood. In many cases feeding sugar syrup to a hive will increase the number of field bees foraging for pollen. This may be of benefit in crop pollination situations where bees collecting pollen are more efficient pollinators than nectar collecting bees.

A) Honey

Feeding honey to a hive in some circumstances is possible, although bees do not seem to do as well on honey compared to sugar syrup. It may be better financially for the beekeeper to sell the honey and buy sugar. If honey has candied in combs then these combs can be stored and given to colonies as required.

B) Sugar syrups

There are a number of methods of feeding sugar to a colony. Sugar fed in a dry form can be used in an emergency. The sugar is heaped, perhaps ½ kg to 1 kg, on the inner mat of a hive. The amount depends on the strength of the colony, as it does in all supplementary feeding situations. This method has been used through winter when the colony is running short of stored honey and it would be detrimental for the beekeeper to interfere with the colony.

3.3.1.2. Protein supplements

The need to feed bee-collected pollen or protein supplements will depend a lot on the amount of brood in the hive, the amount of stored pollen, current and future nectar and pollen conditions and demands to be placed on the hives. If hives are critically short of pollen and either have a large brood nest or are expanding their brood nests, then the beekeeper needs to consider the various options available to avoid a reduction in bee population numbers due to shorter lived.

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Feeding sugar in syrup form is the most popular and probably most effective method ” bees. This ultimately results in weaker colonies that are not suitable for working honey flows or crop pollination.

A) Pollen as a supplement

Naturally-collected pollen is the best source of protein for honey bee nutritional requirements but this pollen can vary in protein according to the floral source. It is largely used to feed developing larvae and young bees to provide structural elements of muscles, glands and other tissues. It is also used in the production of royal jelly, which is a speciality food produced by worker bees that is fed to the queen, developing queen larvae, and worker larvae up to 72 hours of age.

B) Soya flour

Soya flour has been used and recommended by many sources, but not all soya flours are equal. The flour must be expeller processed to remove its high oil content (15%). Solvent-extracted flour will have residues toxic to the bees. Using high-fat soya flour is not a problem if the final mixture of ingredients has a fat level of around 7% or lower.

C) Canola and sunflower flour

Canola and sunflower flour must also be treated to remove their high oil contents. The protein contents are not as high as soya flour and they are said to be not as attractive to the bees. Sunflower flour minimises what bees eat as it has repellent properties. It is best to avoid this ingredient in protein supplements. Sorghum and triticale flour Sorghum and triticale flour have been found to be highly attractive to bees but they are not recommended as the dominant ingredient in a mix due to their very low crude protein levels.

D) Torula yeast

This is generally more attractive to bees than soya flour although the nutritional quality of the yeast varies according to the origin. Protein levels around 50% and fat contents at 7% are quite acceptable. The amino acids are not at acceptable levels, thus torula yeast on its own is unsatisfactory.

E) Brewers yeast and bakers yeast:

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These yeasts are more attractive than soya flour, their protein levels are around 50% and generally they provide a more balanced set of amino acids than torula yeast. Bakers yeast is more expensive than torula yeast and brewers yeast.

3.3.1.3. Vitamin and mineral supplements

These have been added to recipes at 1–3% of the mix but the benefit of this addition is not fully understood as little research has been conducted in this area of honey bee nutrition. This is not a complete list of all substances that have been used or are in use for feeding to bees. It is a list of ingredients that have been considered and used by a few researchers and beekeepers in recent times. To mix large batches of protein supplements, the availability, quality and cost of each ingredient must be considered

3.3.1.4. Supplying bees with water

A supply of water should be available to bees at all times. Water is an essential part of the diet of bees, and a lack of it adversely affects their nutrition, physiology, brood rearing, and normal behavior. The beekeeper should anticipate the need for water and present it to the bees in open pans or trays in which floating supports such as wood chips, corks, or plastic sponge are provided.

3.3.1.5. Commercial supplements

Buying prepared patties or protein cakes may well be an attractive proposition. Many of the commercially available protein supplements have proven to be attractive to bees and provide adequate honey bee nutritional requirements, and their availability is reliable. You also do not have the problem of buying all the necessary ingredients and finding a suitable mixing machine. They may be considerably more expensive, but you only need to buy the quantity that you will use at any one time.

3.4. Identifying conditions affecting plants for honey bees

3.4.1. Soil fertilities for honey bee plants

Soil fertility affects the plants yield much more than it does quality. While it is possible to produce high quality honey bee flora and plants on poor, unproductive soils, it is generally very difficult to produce high quality honey bee flora with an unproductive soil resource. Proper soil phosphorus (P) and potassium (K) levels help to keep desirable legumes in a mixed seeding and also reduce weed problems. It is necessary to balance soil fertility to avoid mineral imbalances in honey bee product.

- **Soil depth;** - To provide sufficient water holding capacity for productive honeybee plant growth, the soil depth must be at least eighty inches.
- **Soil texture;** - Soil texture and depth determine a soil's water holding capacity and therefore strongly influence apiary site's potential honeybee flora production. Soil texture ranging from a sandy loam to silt or clay loam is most suitable for honey bee plant growth.
- **Drainage;** - Most plant species thrive in well-drained soils that have no shallow sub surface restrictive layers. The common types of restrictive layer are clay lenses and volcanic ash layers.

3.4.2. Composition of soils requirement for honeybee plant growth

- Soils comprise a mixture of inorganic and organic components: minerals, air, water, and plant and animal material.
- Mineral and organic particles generally compose roughly 50% of a soil's volume.
- The other 50% consists of pores-open areas of various shapes and sizes.

3.4.3. Function of soil for honey bee floral plants

- hold water within the soil
- provide a means of water transport
- move oxygen and other gases easily
- serve as passageways for soil micro organism
- provide room for the growth of plant root

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3.4.4. Soil PH for honeybee plants

Basically the establishment honey bee plants begins with the proper soil environment. Soil test indicate whether the PH of the soil is suitable for maximum production. Under most situations, the optimum PH value should be between 6.5 and 7.5. In addition to the PH value the availability of elements such as phosphorous, potassium, calcium, magnesium and other trace elements in the soil are needed for proper honey bee plants growth.

3.4.5. Soil moisture for honeybees plants

Available soil moisture is the limiting factor for honey bees plant growth and establishment .sites with less moisture content have limited productivity and may not provide the apiary site should adequate economic return. Therefore the apiary site with adequate annual precipitation should be selected.

Self-Check – 3	Written test
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Name..... ID..... Date.....

Directions: Answer all the questions listed below.

Test I: Multiple choice

- One of the following is not Protein supplements source of feed for honey bees;(3points)
 - Pollen supplements
 - Soya flour
 - Sun flower
 - Sugar syrups

Test I: Short Answer Questions

- What is honeybees floral calendar? (2point)
- What is the importance of soil fertility,ph and moisture for honey bee plants? (2points)
- what does it mean supplementary feeds for honey bees? (3points)

Note: Satisfactory rating - 5 points

Unsatisfactory - below 5 points

LG #32

LO #4- Handle and clean material and equipment

Instruction sheet

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

- Handling waste material
- Handling and transporting materials, tools and equipment
- Recycling materials and disposing disposable waste material
- Cleaning, maintaining and storing tools and equipment
- Reporting work outcomes and difficulties

This guide will also assist you to attain the learning outcomes 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
- Return and Recycle to Store or dispose materials
- Clean, maintain and store tools and equipment
- Report work outcomes and difficulties in completing

Learning Instructions:

7. Read the specific objectives of this Learning Guide.
8. Follow the instructions described below.
9. Read the information written in the information Sheets
10. Accomplish the Self-checks
11. Perform Operation Sheets
12. Do the “LAP test”

Information Sheet -4

4.1. 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.

4.2. Handling and transporting materials, tools and equipment

Whenever we are going to our work area, we have to handle and transport our materials, tools and equipment safely. And also after completing our task we have to take them back to their place (store) safely without any damage on the equipment and ourselves by cleaning and maintaining if necessary.

When you transport equipments, tools and materials sort apart those can be easily broken and place them safely. Lift all equipments by use safe manual handling techniques during loading to any transport means and unloading it carefully. One of the biggest challenges in the beekeeping process is heavy lifting. Hives are lifted for a variety of reasons including transporting to pollination sites, colony inspections, honey extraction, and medication. Before further detailing the reasons for lifting, it is important to understand hives and their individual components.

Before transport bee colony, bee hives and other required materials

- Prepare all protective equipments
- Ask for team work
- Arrange means of transport
- Sort all necessary equipments and arrange it apart
- Handle them in a correct position/ approach the hive properly

The heavy equipments should not load over light and fragile equipments. Do not wave during transportation; it should wrap firmly on the cart or the wall of truck.

4.3. Recycling materials and disposing disposable waste material

After completion of every activity in beekeeping all equipments should returned and placed at appropriate place. It should not be placed on the ground because of rust if it is metal like chisel, uncapping fork and knife, metal sheet queen excluder, etc., the extracted frames must be returned back to the hive after harvesting and the supers should be placed in a ventilated area if it is at the end of flowering period. The old combs should replace by news and extracted to pure wax to make new foundation sheet.

The area should be free from combustible materials, broken items, plastics, news paper and disposed according to waste disposal system.

4.4. Cleaning, maintaining and storing tools and equipment

After completion of the work all materials, tools and equipment ~~they~~ has to be cleaned, sanitized, disinfected, maintained, and stored properly.

Cleaning refers to removal of dirt, filth or unwanted substances from the materials, tools and equipment. The two steps of cleaning involves: wash step and rinse step. Equipment should be carefully selected and washed and maintained before they are sanitized.

Sanitizing is the processes of destroying of micro-organisms on surface after washing and rinsing.

- The purpose of sanitizing and cleaning includes:-
 - a) Reduce health hazards by avoiding contamination
 - b) Prevent the spread of diseases, and food & water contamination,
 - c) Control abnormal odors, and
 - d) Create conducive environmental conditions.

Water is important in the cleaning process

Disinfection: is a process of killing micro organisms.

Disinfectants are chemical substances that kill the majority of bacteria present on a surface but don't kill spores. All harmful or resistant bacteria may not be destroyed, but are reduced to a safe level.

Method of disinfection:

A. Physical

B. Chemical methods

A. Physical method:

1. Moist heat:
2. Hot water:
3. Steam:

B. Chemical Methods:

- This method involves by using chemicals like savlon, alcohol, formalin, iodine solution, potassium permanganate etc

4.5.Reporting work outcomes and difficulties

4.5.1. Definition of reporting

Report: may be defined as a formal statement describing a state of affairs or what has happened. It has detailed description of a problem or a situation, findings of an investigation and recommendations or actions taken.

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Reporting is an integral part of monitoring and evaluation. Reporting is the systematic and timely provision of essential information at periodic intervals.

Beekeeping farming activity should be reported daily, weekly, monthly and yearly to the concerned body as well as for documentation. It is important information and advice from someone who has collected and studied the farm profitability, in order to make decisions and take actions. Reports should be clear, understandable, and meaningful. The outcome measurement process have gone well, poorly reported information will discourage use or provide misleading information. Outcome information can be reported in a variety of ways.

4.5.2. Contents of good report for beekeeping activities

- The report that represents the result of technical, economic and financial feasibility of the work.
- Report serves as guide for the starting and implementation of the planned activities of beekeeping work.
- Report is helpful in achieving the time and cost limits in the completion of the planned activities.
- Report is helpful in obtaining technical and financial assistance from different cooperative organizations and bodies.
- Report reflects commitment of the organization /group of the planned work performers.

Report also includes the following additional points;-

- General information about the work
- Background of the participants of the work
- Details of the work or activities
- Process technical arrangement
- Raw materials and tools
- Schedule of implementation
- Attitude of beneficiaries
- Participation of stakeholders

4.5.3. Types of Reports

Reports could be oral or written. On which oral report is face to face communication which is informal and time saving. On the other hand, written report is formal and relatively more accurate and precise. On the basis of format and procedure; adopted reports may be formal or informal.

A) Informal report is report of person to person communication where as

B) Formal report is presented in prescribed form and procedures.

4.5.4. Characteristics of Good Report

- **Simplicity:** - simple and lucid language
- **Clarity:** - proper arrangement of facts
- **Accuracy:** - unbiased information
- **Precision:** - conciseness or coherence
- **Completeness:** - complete in all respect
- **Relevance:** - to the purpose it prepared
- **Cross-reference:-** making and mentioning
- **Objectivity:** - impartial and free from prejudice
- **Brevity:** - brief without being incomplete
- **Reader oriented:** - for specialist is not appropriate for layman

4.5.5. Report writing format

- A formal report has the following components

1.Title page—the title page must includes subject of the report,who report is for,who the report is by and date of submission.

2.Table of contents

3. Introduction- has three main components

- A. The background
- B. The purpose and
- C. The scope

4. **Body**- the body where according to the report deeply illustrated the main information of an activities.
5. **Conclusion**– a brief and short summary of the main contents
6. **Recommendation**- the personal opinions who, prepare the reports
7. **Reference**– the list of information where the source is gain.

Self-Check – 4	Written test
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Name..... ID..... Date.....

Directions: Answer all the questions listed below.

Test I: Multiple choice

- One of the is **not** physical disinfection methods of materials and tools.(3points)
 - Moist heat:
 - Hot water:
 - Steam:
 - potassium permanganate
- One of the following is statements is **false** about the purpose of sanitizing and cleaning equipments (3points)
 - Maximize health hazards by improving contamination
 - Prevent the spread of diseases
 - Control abnormal odors, and
 - Create conducive environmental conditions.

Test I: Short Answer Questions

- List the waste material which will be produced in work place of beekeeping activities.(4ppoints)

Note: Satisfactory rating - 5 points Unsatisfactory - below 5 points

Operation Sheet -4

4.1 Methods of report writing

A) materials and tools used for reporting

- Papers
- Pen
- Computer
- Printer
- Notes
- Documents

B) Steps in report writing

1. Collect the material (notes, documents etc.)
2. Plan the report
3. Draft the report
4. Edit the report
5. Reporting to the concerned body

LAP TEST-4	Performance Test
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Name..... ID.....

Date.....

Time started: _____ Time finished: _____

Instructions: Given necessary templates, tools and materials you are required to perform the following tasks within **1/2**hour for each task. The project is expected from each student to do it.

Task 1: Perform procedure of report writing.

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