BEEKEEPING : Level-I

Learning Guide-02

Unit of Competence: Support Beekeeping Work

Module Title: Supporting Beekeeping Work

LG Code: AGR BKGI M12LO2-LG-12

TTLM Code: **AGR BKGI M12sTTLM 0919v1**

LO 2: Identify basic bee colony management

Instruction Sheet	Learning Guide #12

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

- Explaining techniques of Bees handling
- Maintaining Hive and apiary.
- Making artificial foundation sheet.
- Identifying Inspection techniques of bee colony
- Identifying Time of inserting and removing queen excluder

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 –

- Explains techniques of Bees handling
- Maintains hive and apiary.
- Makes artificial foundation sheet.
- Identifies inspection techniques of bee colony
- Identifies time of inserting and removing queen excluder

Learning Instructions:

1. Read the specific objectives of this Learning Guide.
2. Follow the instructions described in number 3 to 20.
3. Read the information written in the “Information Sheets 1”. Try to understand what are being discussed. Ask you teacher for assistance if you have hard time understanding them.
4. Accomplish the “Self-check 1” in page 17.
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 Self-check 1).
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.

8. Read the information written in the “Information Sheet 2”. Try to understand what are being discussed. Ask you teacher for assistance if you have hard time understanding them.
9. Accomplish the “Self-check 2” in page 24.
10. 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-check 2).
11. Read the information written in the “Information Sheets 3 . Try to understand what are being discussed. Ask you teacher for assistance if you have hard time understanding them.
12. Accomplish the “Self-check 3” in page 28.
13. Read the information written in the “Information Sheets 4 . Try to understand what are being discussed. Ask you teacher for assistance if you have hard time understanding them.
14. Accomplish the “Self-check 3” in page 34
15. Read the information written in the “Information Sheets 5 Try to understand what are being discussed. Ask you teacher for assistance if you have hard time understanding them.
16. Accomplish the “Self-check 3” in page 36
17. 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-check 3).
18. If you earned a satisfactory evaluation proceed to “Operation Sheet 1” in page 38. However, if your rating is unsatisfactory, see your teacher for further instructions or go back to Learning Activity #1.
19. Read the “Operation Sheet 1” and try to understand the procedures discussed.
20. Read the “Operation Sheet 2” and try to understand the procedures discussed.
21. If you earned a satisfactory evaluation proceed to “Operation Sheet 1” in page 38. However, if your rating is unsatisfactory, see your teacher for further instructions or go back to Learning Activity #1.
22. Do the “LAP test” in page 39 (if you are ready). Request your teacher to evaluate your performance and outputs. Your teacher will give you feedback and the evaluation will be either satisfactory or unsatisfactory. If unsatisfactory, your teacher shall advice you on additional work.

Information Sheet-1	Explain techniques of Bees handling.

1. 1Hunting for Honey in the forest

Honey hunting or Bees Killing is a process where honey hunters/bees killers go in the forest, set fire on the tree hallow/bees nest, kill the bees and press the honey combs, to extract honey. This primitive method of harvesting honey has lot of negative impacts on human and the environment, therefore it should be discouraged.

1.1.1Traditional and modern beehives and beekeeping equipment

Honeybees that nest in the open produce far less honey than those confined in enclosures. There are good reasons for this. Colonies in the open are exposed to predators. Therefore have to employ numerous workers as guards to fight intruders. They have to consume large quantities of honey, which they use as fuel, to enable them to cluster to stop the wind which cools down their combs and to generate enough heat to maintain the proper temperature for brood development. During severely hot days, more bees have to use honey as fuel to enable them to fan and cool melting combs to avoid disaster. This temperature control can only be quite inefficient, because of the colony's exposed condition. The exposed colony therefore has to keep larger numbers of house bees, and will thus have fewer foraging bees available to bring in the needed nectar and other essentials from the field.

It has been seen that the bees' primary natural ranges are in the savannah and semi-arid lands, where temperature variations are extreme. Often the few nesting enclosures available to the bees are in ant-hills and rocks from which honeycombs cannot be easily harvested. Large trees are scarce; few have hollows large enough to house a colony. With the increased interest in beekeeping and the growing demand for bee products and services, bees can no longer be maintained in their few natural dwelling places, but must be provided with special artificial hollows in the form of beehives.

Because the honey hunters do not have training on beekeeping, they go in the forest, to harvest honey without properly dressing or wearing protective cloths. And in the processing

of killing the bees by fire to take the honey combs, the bees become defensive, by stinging and chasing the hunters/farmers. When this happens, the hunters get sick

Traditional hives

Beekeeping is not new in Africa. It has been practiced from time immemorial, especially in the Sahel regions. In these large areas, wooden boards or timber are scarce, and therefore grass and mud have played major roles in providing material for beehive construction.

The grass hive

Dry grasses are woven together in a basket or cylindrical form, usually with entry points at both ends. The hive is installed high in tree-tops to avoid termites. Some beekeepers lower it carefully at harvest time, while others drop it carelessly by cutting the suspension rope. Owing to the weakness of the material, such hives' usefulness is usually less than one year, and they are used for seasonal beekeeping only.

The gourd hive

The gourd provides a natural hollow for bees, but most gourds are too small for an average bee colony, so that their use often induces swarming. There are two types of gourds. One is more or less pot-shaped, while the other has a long neck attached to the "pot" section. Both are installed by a suspension cord or by resting the mouth on a wooden peg.

Most gourd hives have to be broken into pieces before honey and brood combs can be removed. In the savannah areas, some tribes eat both honey and brood, and do not care to wait until there is a maximum of honey to harvest.

The log hive

Two main types of log hive are known. In some isolated areas of the Vest African coasts (e.g. Ghana and Guinea-Bissau), the ciba or palmyra palm (Borassus flabellifer) produces natural hollows for interested beekeepers to use as hives. When the plant dies, the beekeeper waits for termites to consume the soft inner pith. The tree is then felled and cut into pieces and the ends are sealed with woven grass, a few small holes being left at the ends to provide entry and exit for the bees.

For the second type, found in East Africa (e.g. Kenya and Tanzania), a tree is felled and cut into cylindrical logs which are carefully scooped out to form hollows. They are then sealed, leaving some small holes for exit and entry. In Tanzania, the hive is split into halves, which the beekeeper attaches together before baiting and installation. At harvest time, the hive is split open and the honeycombs removed. The halves are then rejoined for the bees to start the next honey crop.

The East African log hive, while simple in construction, is however expensive and inefficient. Several cheap and more productive hives could have been made with wooden planks from the same tree if only it had not been crudely shaped into log sections first.

The barrel hive

Metal and wooden barrels are sometimes employed as beehives in some places in West Africa. In Guinea-Bissau, for instance, barrels containing pigs'-feet or wine, imported by the Portuguese, were adapted for use as hives. Some of these old barrels are deteriorating, however, and no new ones are available to replace them.

The clay-pot hive

The cheapest and most durable of all the traditional hives is the clay pot, very popular especially in the northern savannah of West Africa. The pot is similar to the type generally used to carry water or other liquids, modified to provide a wider mouth and a small mid-section hole for both exit and entry.

The pots, usually made by the elderly women, are bisque-fired, and the inner part is smoked as part of the baiting. They are then baited with cow dung or other waste and installed on the ground or on pegs in trees. In some areas, the pots are turned upside down directly on the ground, for beekeepers find that when they are installed on a flat plate or wood, bees glue the plate firmly to the hive with propolis, making harvesting tedious. This method of installation, however, has a serious drawback: frequent ant invasions force some bee colonies to abscond.

Traditional beekeeping utilizes cheap and plentiful local materials for hive construction, some of which would otherwise be wasted, e.g. the ciba palm. But such simple beehives cannot be easily manipulated because bees fix combs to the hive body. Combs cannot be inspected at all, and detached combs cannot be easily replaced. To counter this problem, traditional

beekeepers should adopt the top-bar system as a simple, modern way to convert traditional hives into movable-comb hives.

Modern rives

The design of all modern beehives is based on the discovery, by the father of modern beekeeping, Lorenzo Lorraine Langstroth, that when bees build their combs they always leave exactly the same amount of space (the bee space) between them (see pp. 39-40). On the basis of this finding, Langstroth invented a hive with frames separated by this bee space, in which the bees could build their comb. The frames are so arranged that they can be removed individually without disturbing other combs and without crushing bees, and the sides and bottom of the frame provide very good support for the comb.

Langstroth also found that several communicating hive boxes can be stacked one above another, and that the queen can be confined to the lowest, or brood, chamber, by means of a queen excluder. In this way, the upper chambers (called supers) can be reached only by the workers, and therefore contain only honey-comb. This made hive inspection and many other management practices possible, and turned the art of beekeeping into a full-scale industry. Almost all commercial hives in use today operate on the Langstroth pattern, although they may contain from 10 to 13 frames.

Other bee enthusiasts have given their names to similar hives that are essentially modifications of the original Langstroth, and these frame hives are in general use throughout Europe, North America, Australia, and parts of South America and Asia, as well as in some northern and southern African countries. For technical and economic reasons set out on pp. 44-45, however, most African countries, mainly in the tropics, are not yet in a position to use frame hives, and for them the top-bar hive represents a satisfactory compromise, although it is admittedly less efficient and perhaps somewhat more difficult to use, especially for beginning beekeepers.

The top-bar hive

In the top-bar hive, the Langstroth frame is replaced by a simple modification of the top bar of the Langstroth frame, and the bees build their combs hanging down from the centre of the bar. Since the combs are not supported on all four sides as they are in the Langstroth frame,

they can break more easily, but because they are fixed only to the top-bars and not to the hive body, it is still possible -- with care -- to remove and replace them at any time for inspection or other management practices.

While boxes built especially to receive top-bars give the best results, clay pots, barrels and most containers used by traditional beekeepers can easily be fitted with top-bars: the important thing is to maintain the proper, equal distance between the combs.

Cut any piece of wood to fit the size of the container's opening. The width of the wood must be exactly 32 millimetres (3.2 centimetres or 11/4 inches). This is a crucial measurement. The tropical honeybee builds a comb which has a thickness of 25 millimetres. This comb is usually attached to the centre of the top-bar. A space of 3.5 millimetres is thus left at either side of the comb. When two or more top-bars fixed with combs are placed side by side, the inner space becomes 7 mm (i.e. 3.5 mm plus 3.5 mm). This space, vital to the bees, is usually referred to as the "bee space". These bee spaces are also found between the combs and the hive body. They serve the bees as paths in which they can move freely.

Advantages and disadvantages of frame and top-bar hives

Advantages of the frame hive

a) The comb is fixed firmly to the four sides of the frame. This facilitates easy harvesting, and the beekeeper has little fear of damaging the comb.

b) The strength of the built-in comb also allows easy transportation, even over bad roads. It also affords easy control of a colony of bees without fear of breakage before the arrival at the new destination.

c) Honey is extracted by means of the centrifugal honey extractor, which makes it possible to remove the honey without damaging the comb. Empty combs are returned to the hive for the bees to refill with new honey, thus saving the insects from wasting time and energy to construct a replacement comb. Honey harvests are maximized, as the beekeeper can obtain several honey crops within the year. In Canada, for instance, a frame hive with a strong colony of bees may produce over 200 kg of honey per year. Thus, it is ideal for a serious large-scale honey production programmed.

d) During hive manipulations, very few bees are crushed between frames, whereas dozens of bees can easily be killed by careless handling of top-bars.

e) The hive is so designed (with queen excluder and supers) that the queen and brood are confined to the lower chamber. Supers contain only honey, and the lower brood chamber is undisturbed when honey is harvested.

f) Stealing a double- or triple-storey hive with a colony is a difficult feat for a thief. The Kenyan top-bar hive, on the contrary, can be carried away easily.

g) A swarm of bees can be hived with ease. Bees can easily pass through the numerous spaces between the frame and at the top of the hive.

h) Hive boxes can be stacked easily. This makes it easy to expand and contract the hive to meet the needs of the bee colony.

i) Drugs can be applied with ease through the openings.

Disadvantages of the frame hive in tropical Africa

a) A frame hive with two supers costs three times as much as a Kenyan 27-top-bar hive.

b) A high degree of craftsmanship is required to build the hive. Frame dimensions must be precise. Local village carpenters are not usually skilled enough for the job, and suitable tools for large-scale production of frame parts may not be available. Even if they are, it is never certain that the craftsmen have the patience to construct the hive correctly. Hives ordered for use in Ghana by the Technology Consultancy Centre failed to achieve the desired goals due to lack of precision in construction.

c) Wood for frame construction must be seasoned for at least a year. Very few carpenters or entrepreneurs can tie up their capital in this way.

d) The need to keep a stock of frames to replace those removed during the honey harvest creates an additional cost.

e) The need to import centrifugal honey extractors, decamping-knives, trays and other sophisticated equipment cannot be ruled out. In many countries, currency to order these from abroad cannot be obtained easily by local beekeepers.

f) If frames are unguided, honeybees find it difficult to start the combs correctly on the frame. The beekeeper has to install a wired comb foundation which is not available. The only foundations that can be ordered from abroad cannot be successfully used by the tropical honeybee, because the African bee is smaller than the European bee, and the cell size on imported foundation is too large for African bees.

g) A hive with supers is heavy and difficult to carry as a head-load; therefore, a vehicle may be required to move colonies if the need arises.

h) Because the frames do not fit together as the top-bars do, it is very difficult for the beekeeper to control the numerous bees which pass through the spaces between the frames and the top of the hive. This problem is very serious with the transitional long hive, which has as many as 30 frames arranged in a single-storey rectangular box. Such a beehive needs a special large smoker, and even such a smoker may not be able to produce enough smoke to "cool" the aggressive bees. The new beekeeper, upon seeing hordes of bees escaping, may run away, leaving the hive uncovered.

In the light of these serious problems, it is advisable for the beginner to start with the simplest type of movable-comb hive, which is, of course, the top-bar hive.

Advantages of the top-bar hive

a) This hive is cheaper and easier to produce than a frame hive. Any semi-skilled carpenter can make it. Only a few simple carpentry tools are required.

b) There is little or no need to import anything. All materials required can be obtained locally.

c) The hive can be opened easily and quickly. There is little or no need to employ a hive tool. Top-bars can be constructed to overlap the sides of the hive body slightly, and this makes it possible to use the thumb to pry up the top-bar.

d) Top-bars occupied by combs can easily be detected, so that the hive is opened from the empty side. This avoids crushing the bees between the top-bars when lifting the first comb.

e) Bees in the top-bar hive can easily be controlled when harvesting or inspecting the combs. The smoker puffs smoke through the opening created by the removal of one top-bar. Few bees can attack, since the beekeeper drives them away with smoke. When the top cover is

removed from the transitional long hive, all the frames' 7-mm spaces are exposed, which permits numerous attackers to fly out and attack the beekeeper.

f) The top-bar hive is lighter to carry, even when the colony is inside.

g) More beeswax can be produced. Sales of beeswax increase the beekeeper's earnings and solve a great national problem. Beeswax is a multi-purpose industrial raw material required by factories and craftsmen.

h) There is no need to employ a queen excluder, which at the moment is not available. In practice, the bees keep their brood chamber separate from the honeycombs. Clean honey can be taken away, leaving brood combs undisturbed.

i) Honey production can be high. A well-managed hive with a good strong colony can produce between 50 and 120 kg of honey annually.

j) Honeycombs adulterated with pollen can be of high value. Pollen is a nutritious food supplement; the only way the nutrition is passed on is through honey harvested from such combs.

k) Only a few extra top-bars need be held in stock to replace worn-out or damaged bars.

In general, the top-bar hive is significantly cheaper and easier to use than hives with frames. The following disadvantages, however, cannot be overlooked.

Disadvantages of the top-bar hive

a) A newly-constructed comb and all combs filled with honey must be handled with the utmost care. It is not advisable to move a top-bar hive, occupied by bees and combs, on lorries along bad roads full of potholes.

b) Honey can only be extracted by destroying honeycombs, either by using the solar wax alter to dissolve the comb cells or by crushing them and squeezing out the honey. Bees have to build up new ones in their place, and this involves time, material and resources of the honeybees.

c) Bees are often crushed between top-bars as the beekeeper rearranges the bars after removing them from the hive body. This problem can be serious when colonies are

manipulated at night. When bees are crushed in this way, it is difficult to fix the last top-bar into place. Crushing bees is usually not a serious problem with frame hives.

d) A top-bar hive is relatively easy to steal, as it is light and compactly designed. It is more difficult to steal hives and supers arranged one above the other.

The hive entrance

The tropical honeybee colony seems to attach great importance to the design of the hive entrance. After colonizing a hive, the workers select among themselves suitable "masons" which use propolis to re-shape the entrance to conform with their own taste. They rebuild it, taking into consideration strategies to deal with their enemies. They close up the entrance if it is too large, leaving a space not more than 7 mm high. This prevents birds, reptiles and larger insects such as beetles and butterflies from entering. If the entrance gap is less than what the bees require (due to an increase in population and foraging activity), they will widen it by chewing the wood or removing propolis. The re-shaping of the entrance helps to protect a weak colony. It also helps to prevent water from entering from the outside platform even if the hive is tilted upward.

The landing board

The tropical honeybee seems to be satisfied without a landing platform, but one must be provided because some heavily-loaded foragers sometimes fall on their back when landing. If a lizard or a toad is close by, such a forager will be swallowed in no time.

The swarm-catcher is a small beehive, usually containing only five or six top-bars or frames. Thanks to its small size, it can be carried high up in a tree. The beekeeper then visits it frequently to find whether the box has attracted a swarm. If it has, the box is lowered or carried down and the bees, together with their combs, are transferred carefully into the beehive, which is four to six times the size of the catcher box. The top-bar or frame of a swarm-catcher should have the same dimensions as that of the beehive to facilitate easy transfer of bees and combs from one to the other. The shape of the catcher box for Kenyan top-bar hives should not be different from that of the beehive. If it is, new combs built by the new swarm cannot be easily transferred into the main hive unless the beekeeper reshapes them to conform with the shape of the hive.

The queen cage is a small container designed to hold and carry the queen and a few "attendants", usually between six and ten worker bees. This is important only when the queen is being transported from one place to another. In the absence of a neatly-designed queen cage, a match-box can be used. It is important to perforate the box with tiny holes to give the bee the needed ventilation. This is done by simply heating a metallic rod and drilling it into the light wooden cover of the matchbox.

1.1.2 Equipment required by the beekeeper

The smoker is next in importance to the beehive itself. No honeybee will ever allow a beekeeper to harvest its honey without a fight. The tropical honeybee is noted for its aggressiveness, and the beekeeper is warned not to conduct any brood control or harvest without using his smoker.

The smoker has two main parts: the container, which is a metallic can, big enough to carry enough dry material to last at least 40 minutes; and the bellows section, which puffs air into the container to drive the smoke out of the can. The container is loaded with wood shavings, smoldering cow-dung or any dry material which provides white smoke. (No oil or kerosene should ever be used in a smoker.) The smoke renders bees docile, so that the beekeeper can work undisturbed.

A hive tool may be necessary to pry up and remove the frames from the beehive. The Kenyan top-bar hive may not need a hive tool, but a knife instead.

A knife may be required to pry open top-bars or frames which are usually glued to the hive body by the bees. The knife is also useful for cutting a portion of the comb attached to the hive body, separating two combs joined together, and cutting out the honeycomb from the top-bar during the honey harvest. A knife can perform almost all the functions of the hive tool, but the hive tool cannot be used to cut bee combs as neatly as is required.

The brush or quill: Bees must sometimes be brushed gently into a container or a hive. A brush with soft hairs is useful for this, but if the beekeeper can easily obtain a strong, large quill like an ostrich or turkey feather, there is no need to acquire a brush. Indeed, the quill of a big bird is better than any artificial device for this purpose.

The feeder can be a jam jar or a special container turned upside down and so arranged that water trickles slowly from it for the bees to drink.

Protective clothing: Most traditional honey-tappers prefer to strip themselves naked than to wear clothes when harvesting honey at night, but the modern beekeeper is advised to acquire suitable protective clothes to keep the bees from reaching his flesh. Thus a bee suit, gloves, veil and a pair of boots should be acquired before the honey is harvested or any work involving the opening of the hive is undertaken. When working with bees during the daylight hours, light-colored clothing (preferably white, yellow or green) should be worn; for night work, dark colors are better.

The bee suit is sewn to cover all parts of the body except the head, hands and feet. Bee suits are worn to harvest honey and to control the brood nest during the daylight hours.

The veil is the most important. The beekeeper can easily make or purchase a straw hat (or any type of hat with a brim). Netting is sewn firmly around the hat and attached at the back by a piece of cloth. The veil protects the head, face and neck from attack.

Bee gloves must be sewn with good, flexible white leather to protect the hand and fingers from stings and help the beekeeper to scoop up bees with his hands if the need arises. Indeed, bee stings on the hand or fingers are among the most painful, and the beekeeper is urged to acquire gloves to ensure that he works with little or no difficulty.

A pair of long boots is also important to protect the feet from stings. When they are not available, a pair of light shoes and thick white socks can be worn. Dark or black socks should only be worn at night when the bees, vision is poor.

1.1 .3 Handling honey bees when opening a hive

In cooler area, beekeepers who can choose when they open their hives should work on a warm, dry, windless, Sunday; when most of the older bees aren't inside the hive. In any case, Hives should not be opened during cold temperature, windy and rainy days when all the foragers are inside the hives. Bees are especially likely to sting when there is no nectar flow.

Colony conditions which makes the bees more difficult to handle included the following; a very large population, presence of many old bees, previously alerting of the colony by disturbances of any kind, robbing by bees from other colonies, queen less or super secure, and starvation.

1.2 Bee packaging

It is a modern way of transporting bees from one place to another.

- Before an attempt to transport prepare final destination sites, boxes and hive stand.
- The bees after reaching the destination site, has to be transferred into box hives immediately.
- A swarm trapping and transporting box properly designed for the purpose is known as bee packaging box or nucleus hive.
- It has a separate feeder for the queen and worker bees during the journey. Such kind is an appropriate box for trapping and transporting bees to any distance across the country.
- But the queen has to be placed in a separate cage with ample food;
- Possible to transport as many colonies say 100 or 200 at a time.
- Better to drive at night to minimize heat stress
- Keep water and water sprayer with you.
- When relocating a hive over a long distance (more than 2 km), first of all plug up the entrance holes at night when all the foraging bees are in hive and make sure there is no other escape for the bees; transport it carefully to a well-shaded and protected place.
- When relocating a hive over a short distance (less than 2 km):
- If you simply move the hive directly to a place which is less than 2 km away from your original site, (that is 100 m or less), the “field bees” would return to the original place because of their sense of orientation. As a result you would lose them all. What you have to do is:
- First close the hive
- Take the hive to a place, which is 3 km away from both the old and the new proposed site.
- Leave it there for at least 2 weeks.
- Then transport it to the new site. During the 14 days at the temporary site the “field bees” will have forgotten the old site.

- If the hive is to be moved between 20 and 100 m you may also carry the hive to the new site straight away, but then you have to collect clusters of stray older bees at the original site repeatedly which are then shaken into the new hive.
- If you want to relocate your hive less than 20 m away, you can move it in steps of 2 m every third day until you have reached the new site.

1.3 Bees management

Every agricultural activity depends for its success on the execution of a series of coordinated operations determined by the cycle of the seasons and by the weather and other conditions prevailing at a particular moment. Land must be ploughed, fertilized and seeded; if the rainfall is insufficient, the crops must be watered and if it is excessive they must be protected against mildew; pesticides and herbicides may be needed; the time of harvesting must be chosen with care.

In beekeeping the purpose of colony management is to ensure that the maximum strength of the colony coincides with the maximum nectar flow, in order to obtain a maximum honey production. When no pollen and nectar are available, the colony must survive on its reserves, and economy of operation is therefore requires that breeding be reduced to a minimum, to be renewed again in anticipation of the honey flow. Many conditions must be met in order to achieve this purpose, perhaps the most important being a sound knowledge of the dates of the normal flowering periods of the honey plants in the area of operation.

Self-Check -1	Written Test

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

1. What is box hive means? box3 points)

   A. It is modern hive
   B. It is transitional hive
   C. it is traditional hive
   D. nucleus hive

2. What time is advisable for bee transporting?(5 points)

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3. Write advantage of: transitional hive, traditional hive and modern or movable frame hive (5points)
4. What is the reason honey bee transferring in Ethiopia?(5 points)

   _____

   _____

Note: **Satisfactory rating - 3 and 5 points** **Unsatisfactory - below 3 and 5 points**

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

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions

Information Sheet- 2	Maintain Hive and apiary

2.1. Site selection: Productive beekeeping depends on good colony management and good beekeeping areas, in order to promote it as a profitable agricultural occupation, areas with good potential for beekeeping must be located and evaluated. Successful site selection is important to promote sustainable bee culture development and to save time, energy, and capital investment.

Apiary sites are often limited for a small-scale beekeeping venture. Choosing a site often involves balancing the needs of the bees against those sites available.

The following should be important in site selection and establishment of modern apiary.

- Referring to lists of known major honey plants in other countries or regions with similar vegetation patterns, agro-ecosystems, climate and edaphic conditions, determine whether similar plants are to be found in the area under study.
- The mere presence of flowering trees and shrubs in limited numbers, or a few hectares of land covered with good honey plants preferred by bees, does not necessarily indicate that the areas has potential for commercial beekeeping.
- Practical, large-scale beekeeping operations call for large areas, usually hundreds or thousands of hectares of nearby land bearing good forage with high population densities. Good honey plants are characterized by relatively long blossoming periods, generally in terms of several weeks or months; high density of nectar-secreting flowers per plant or unit area; good nectar quality with high sugar concentrations; and good accessibility of the nectarines to the bees. The foraging land should be well proportioned, in terms of the width, so as to promote foraging efficiency.
- The supporting capacity of an area for honey production is best determined by monitoring weight changes in the bee colonies. Among other factors that affect the

economic value of an area for beekeeping are average hive yields, prevailing honey prices in the area, as well as costs of colony management inputs.

- The large-scale planting of honeybee forages has never been proved to be a profitable approach in terms of net economic return, except in integration with other activities, such as reforestation, roadside plantings, animal pasture, etc.
- The area should have potential water around that satisfies the needs of bees.
- A chemical free area is necessary i.e. it should be away from air and water pollution.
- The site should be away from prevailing wind. The site should be accessible to ease travel, transport working tools and equipment.
- Environmental factors such as temperature, rainfall, altitude, and humidity.
- Seasonal factors such as major rainfall months, short rainfall months.
- Locate apiaries where they are out of flood danger from drainage areas.
- Place the hive so the entrance faces away from prevailing winds.
- Place bee colonies on concrete or stone foundations one foot or more above the ground for ease in handling and to protect the colonies from damage by termites and ants.

2.2. Honeybee Plants: In order to survive, prosper and be productive, honeybee colonies must have a supply of both nectar and pollen in adequate quantities. Not all plant species are equally good for beekeeping. Some supply both nectar and pollen abundantly when in bloom, and these are called Honey plants, because they are best suited for honey production. Plants producing nectar but little pollen are also considered to be honey plants. Other plants, however, may yield pollen but little or no nectar. These pollen plants are also important in beekeeping, especially at the time of colony build-up, when the bees need large amounts of the protein contained in pollen for their brood rearing.

Ideally, a good beekeeping area is one in which honey and pollen plants grow abundantly and with a relatively long blooming season. Such areas are, however, not always available or easy to find. The beekeeper therefore combines his skill in colony management with migratory practices in order to provide his bees with good, productive foraging environments. He must know the time and duration of the blossoming season of every major honey plant, including the environmental factors affecting them, and make a reasonable assessment of the supporting capacity of each area, i.e. the number of colonies that can be put to productive work there.

2.3. Floral Calendars: A floral calendar for beekeeping is a time-table that indicates to the beekeeper the approximate date and duration of the blossoming periods of the important nectar and pollen plants in his area. The floral calendar is one of the most useful tools of the apicultural extension worker. It enables him to inform the beekeeper on what to expect in bee forage availability, and when, so that they can manage their colonies in the most rational manner. Beekeeping in any specific area cannot develop without an understanding of the calendar, and for migratory beekeeping, special calendars for the different foraging zones along the migration route are required.

Assembling a floral calendar for any specific area is simple but time consuming. It requires complete observation of the seasonal changes in the vegetation patterns and/or agro ecosystems of the area, the area, the foraging behavior of the bees, and the manner in which the honeybee colonies interact with their floral environment.

The steps normally taken in building up floral calendars are:

- The beekeeper makes a general survey of the area, drawing up a list of flowering plants found, special attention being paid to plants with a high floral population density per unit area pr per tree.
- He places several strong honeybee colonies in the area, inspecting the hives regularly and observing changes in the amount of food stored within the hive to determine whether it is depleted, stable or increasing. Any food gains or losses can be monitored by weighing the hives.
- At the same time that he monitors the hives food stores he surveys areas in the vicinity of the apiary and within the flight range of the bees, to record the species of plants that the bees visit.
- He determines whether the plants are visited for nectar or for pollen. Pollen foragers will have pollen pellets attached to their hind legs. To determine whether the bees visit flowers for nectar, tasting it for sweetness or measuring the nectar concentration with a hand refract meter.
- He studies the frequency with which the bees visit each flower species, in relation to changes in the level of the colonies food stores. If there is a continuous increase in food stores, in direct response to the availability of the plants visited, the plants are good forage sources. When the food stores remain stable, the plants can be depended up on to meet the colonies daily food requirements, but they cannot be classified as major honey sources.
- Once all the data on forage species have been assembled and repeatedly verified, they should be judged as they relate to the actual performance of the honeybee colonies. The

calendar can then be drawn up in the form of circular or linear charts, showing the weekly or monthly availability of each plant and their flowering sequence.

Table: Important Honeybee Plants of Ethiopia

Botanical name	Common name	Propagation	Apicultural use
Opuntia ficus indica	Beles	Cutting	Major honeybee flora
Becium grandiforum	Mewatis, Tebeb (Tig)	Cutting, seed	Major
Acacia nilotica	Girar	Seed	Pollen source
Euclea shimperi	Dedeho	Seed	Nectar source
Parkinsonia aculeta		Seed, seedling	Good honeybee flora for arid areas
Eucalyptus camadulensis	Key bahirzaf	Seedling	Major
Hypoestes	Girbiya (Tig.)	Seedling	Major
Vicia dassycarpa	Gaya	Seed	Nectar source
Vernonia amydalina	Grawa	Seed	Major

Guizota scabra	Mechi	Seed	Nectar and pollen source
Maytenus ovatus	Atat	Seed	Nectar, pollen, Propolis
Sesbania sesban	Sesbania	Seed, seedling	Nectar, pollen
Cordia Africana	Wanza	Seed	Nectar, pollen
Rhus valgaris	Yeregna kollo	Seed	Nectar, pollen
Euphorbia candelabrum	Qulqual	Cutting	Nectar, Pollen
Agave sisalana	Qacha	Seedling	Nectar, Pollen
Euphorbia tiruciae	Kinchib	Cutting	Nectar, Pollen
Lepidium satilvum	Feto	Seed	Nectar, Pollen
Schinus molle	Kundeberbere	Seed, seedling	Nectar

2.4 Apiary site preparation:

Prepare the selected area before installation of hives:

- Level the ground

- Fix the fence
- Make fire trench around the fence
- Soil treatment if necessary
- Clear weeds or unwanted vegetation
- Erect shelter
- Provide water if not presented around the site
- Erect weatherproof bee house
- Fumigate the house before the storage of hive materials
- Provide sanitary facilities periodically check for the presence of ants
- Windbreak: quick-growing trees or shrubs can be planted around the apiary to shade the hives. Melliferous plants should be chosen for this whenever possible. In many areas, castor bean is a good plant to use.
- Shrub rows that separate the hives from each other and from dwellings can help minimize stinging incident.

A. Installing the modern hive in the apiary

Make the ground even

Install the hive stand. Check the firmness of the hive stand. If it shakes provide filling materials below the leg, which is not grounding properly.

Arrange the frames inside the base hive. Check the bee space, between the frames and between the frames and the hive walls. If there is any unsuitable frame, replace it. After making sure of bee space, number the frames. Now, remove the frames, wire them and fix the comb foundation sheets.

B. Apiary arrangement: The arrangement of the apiary is important to help meet the needs of the bees and to help make beekeepers work easier. In most areas of the tropics it is necessary to put the hives on stands to protect the bees from ant and toads. The stands should be at least 45 cm above the ground. The legs can be placed in cans that contain used motor oil, or bands of grease can be placed around them to keep ants from the hives; fresh ashes spread around the legs also keep ants away. Since the KTBH consists of a single box, it can also be hung from a tree or from poles. This protects it from ants and toads and from bush fires as well.

Keeping weeds cut in the apiary also reduce the ant problem. Tall weeds can provide bridges to the hives for the ants

If there is no source of water for the bees within one kilometer, a container of water with floating sticks or protruding stones can be placed in the apiary.

Hive arrangement within the apiary is also an important consideration. Avoid placing the hives close together in long straight rows. Such placement results in a lot of drifting or confusion of bees between colonies. Drifting can contribute to disease transmission. To prevent drifting, the direction of the hive entrances can be varied, and lines of hives can be broken up with landmarks such as trees or shrubs. Hives should be at least 45 cm apart, and slightly tilted toward the entrance to aid the colony in removing residue that falls to the bottom. This also allows rainwater to run out. The placement of hives should allow the beekeeper to approach the colony and work it from behind. This is less disturbing to the colony since it does not interfere with the flight path of the foragers. It also allows the beekeeper a chance to smoke the colony before the guard bees at the entrance are alerted.

Hives should not be in direct sun light during the hot periods of the day, nor should they be in constant heavy shade. The ideal site would receive sun in the morning so that the bees start to fly early, and shade in the afternoon so that the number of bees ventilating the colony and foraging for water is minimized.

The apiary site should also allow for good air circulation so that it does not remain damp for long periods after wet weather. Avoid areas that flood during rainy periods. Areas under high trees often provide good apiary sites because they dry out quickly afterwards and are not excessively shady.

Avoid areas of constant wind for apiary sites. Such winds hinder the bees from flying. If there are no natural windbreaks, they can be planted. Melliferous plants can serve a double purpose. Such living fences can also serve to keep livestock away from the hives.

Self-Check -2	Written Test

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

1. list at least 3 honeybees flora plats that are found around your environment. (3 points)

_____

_____

_____

_____

_____

_____

2. what is site selection means for apiculture(3points)

_____

_____

_____

_____

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

Information Sheet-3	Make artificial foundation sheet.

3.1 Beeswax:

Beeswax is an easily stored, non-perishable product. It is used in some areas by local craftsmen and artisans, tanners, leather workers and candle workers. Beeswax can also be used in the making of wood polishes. While in most area
s there is a ready local market for honey, this is not always true for beeswax. In some areas it may be necessary to create a market for the wax.

Embossed wax foundation is a thin sheet of beeswax with the pattern of hexagonal cell bases impression on each side of it. It is used in frame hive beekeeping to encourage bees to build comb in the way that is most convenient for the beekeeper. A narrow, deep container is used for melting the bee wax.

3.2 Embossed comb Foundation provides following advantages:-

a) It encourages bees to build straight combs within wooden frames. This allows easy and rapid manipulation of honey bee colonies.
b) It saves bees' resources and labor in the construction of combs thereby allowing increased honey production;
c) It facilitates honey extraction since combs in frames can be strengthened by reinforcement with wire

.3.4 Method of foundations sheet production

1) Tray-style foundation press

This is a press into which molten beeswax is poured and molded on each side with the pattern of foundation. These presses can be made of metal, plaster of Paris, or plastic, and tend to produce rather thick sheets of foundation.

2) Roller methods

A flat sheet of wax is run through embossed rollers, resembling the clothes mangles used in laundries.

Some commercial foundation manufacturers have sophisticated machines in which liquid beeswax is poured straight on to a water-cooled roller embossed with the hexagonal cell pattern. The wax is solidified and printed simultaneously. The sheets of embossed wax are then cut into the rectangular sizes needed for frame hive beekeeping.

Fixing of comb foundation on the frames.

The embossed comb foundation sheet is trimmed and fitted into brood or super frames. For fixing the comb foundation sheet a narrow, deep groove (lengthways in the middle of the

underside of the top-bar is done. Than place the wax sheet into the groove and apply some molten wax to the line of attachment using a spoon. The wax sheet will be held in place when the molten wax has cooled.

3.4 **Requirements/consumable/ material or tool**

- Bee wax
- Mould(wax printer)
- Wax molder
- Spoon
- Dish
- Omo (soft soap)
- alcohol
- Heater/ knife or electrical impeder Required

3.5 stapes for artificial foundation sheet making

Step1, container is taken for the melting the wax and other tools

Step2, heated in a water bath to 68°-72°C.

Step3, Beeswax is added to the container until it is filled to about 5.0 cm of the brim.

Step4, A long glass/water proof ply board/ smooth piece of wood sheet of width a little narrower than the melting container is dipped into the molten wax for about three seconds and then lifted out to cool

Step5, Thin sheets of wax formed on each side of the glass are peeled off and placed on a flat surface to harden. This is soaked in water for 24 hours before use

Step6, To facilitate the removal of the wax sheets from glass or wood, a weak solution of liquid washing soap is applied before dipping in the wax.

Step7, The sheets are passed one by one through a reeling mill which is hand /electric operated.

Step8, The rollers press the sheets to a uniform size and thickness and embossed hexagonal impression

Step9, Separate rollers are used for making comb foundation for

Apis cerana indica and A .mellifera

Self-Check -3	Written Test

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

1. List out stapes of foundation sheet preparation.(**4 points**)

   _____

   _____

   _____

2. Write the two methods of foundation sheet production(4points)

   _____

   _____

   _____

   _____

3. Write materials which used to of foundation sheet production(2points)

   _____

   _____

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: _____

Information Sheet-4	Identify Inspection techniques of bee colony

4.1 External examination of a hive

While an experienced beekeeper can usually have a fair idea of how his colonies are progressing by observing them from outside, the only means of knowing for sure whether everything is going smoothly is to open the hives and inspect each comb.

The general rules for hive inspection are:

- Look at each hive from a distance or from behind the hive entrance.
- Start from weak colonies to strong colonies.
- Hive entrance should be clear, clean from dead bees, ants, termites and straw.
- Observe the condition of the bees near hive entrance, if they are weak, crawling and bees with pollen loads and number of bees coming out for foraging.
- Take good notes on the ones needing further inspection by opening hive lid.
- Examine hive distance or spacing between hives, placement and position of hive and the wind direction.
- Check if there are watering and flowering plants.
- Examine the potential resources available and estimate the flow of pollen and nectar carrying bees.
- Evaluate the interest, working capacity and the handling of bees by farmers.
- Study on some recorded history of the sites.
- Check if all the colonies are under shade and how close to each other.

In cooler area, beekeepers who can choose when they open their hives should work on a warm, dry, windless, sunny day; when most of the older bees are not inside the hive. In any case, hives should not be opened during cold temperature, windy and rainy days when all the foragers are inside the hives. Bees are especially likely to sting when there is no nectar flow. Colony conditions which make the bees more difficult to handle include: a very large population, presence of many old bees, previously alerting of the colony by disturbances of any kind, robbing by bees from other colonies, queen less or supersedure, and starvation.

Always wear protective clothing. Open the hive when necessary, and then as briefly as possible. Always work at the back of a hive, away from the bees' flight paths in front of the hive entrance. All movement should be smooth and deliberate, not jerky or rough. Do not bump or jar hives of frames. Keep boxes of frames of bees covered,

to reduce the number of bees flying and to prevent robbing; manipulating cloth can be useful for this purpose.

The beekeeper should take into account the fact that bees react strongly to certain smells such as perspiration, alcohol, soap and perfume. Avoid carrying these strong smells. Do not keep animals near the bees. Since bees can be entangled in hair and woollen clothing, avoid wearing clothes made of these materials. Wear clothing of the lightest possible colour. When bees are aggressive they will always go for dark colours first.

Make sure that you have smoke when you want to open the hives. Always first blow the smoke at the flight entrance. Always make sure that you have enough fuel for the smoker at hand. If you have been stung you must kill the bee that has stung you and then scrape the sting out of your skin with a fingernail or a sharp object.


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Internal Hive Inspection

Pry open the lid of the hive if it is propolized. Detach the frames from the side of the hives using hive tools or knife.

- Then remove the first comb and inspect it. If it is a brood comb, look at the cells to see whether the cells are filled regularly and well sealed, and specially whether the comb contains queen and the drone cells as well as the worker cells; this is a sign that the colony is preparing to swarm. If it is a honey comb, examine whether the cells are fully capped (containing ripe honey) or uncapped or partly capped (unripe honey)
- Replace the comb, give puff smoke, go on to the next operations and repeat it until all the combs have been inspected.

If more than ten brood combs are found, remove the excess because if too much brood is allowed to emerge, the hive will become overcrowded and the colony may abscond. These brood combs can be replaced in another hive to strengthen its colony if necessary.

Self-Check -4	Written Test

Directions: Answer all the questions listed below. Encircle the letter

1, One of the following is **not** the general rules for hive inspection (4point):

A .Look at each hive from a distance or from behind the hive entrance.

B .Start from weak colonies to strong colonies.

C. Start from strong colonies to strong colonies

D. Hive entrance should be clear, clean from dead bees, ants, termites and straw

Note: **Satisfactory rating – 4 points** **Unsatisfactory - below 4 and 4 points**

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

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Information Sheet-5	Identify Time of inserting and removing queen excluder

5.1 Time of inserting and removing queen excluder

When & Why To Use A Queen Excluder

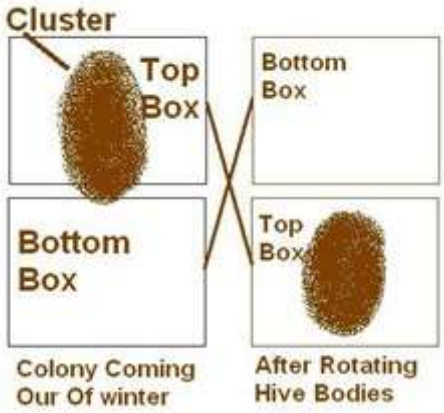
The most common use of a queen excluder is to place it directly above your top brood box. Then, all honey supers **are placed above the excluder. The excluder then is able to keep the queen in the brood chambers and excludes** her from getting into the honey super and laying eggs. Excluders are also used in hives where the beekeeper is operating a two queen hive.

I generally do not use queen excluders on my hives for several reasons.

1) To me, they are high maintenance. The bees often attach comb to the excluder thus reducing the passageway, 2) Drones can become stuck and reduce the passageway, I want my bees to be able to easily go in and out of the honey super, so I fear that the excluder discourages the bees from filling a super if they have to work their way through an excluder.
I am often asked whether a new beekeeper should use a queen excluder. For the most part, I would say yes. However, when that same new beekeeper calls me up and tells me his bees are not going up into the top super, I would recommend removing the excluder. This is why I am reluctant to recommend queen excluders. Some beekeepers call them honey excluders.
You probably want to know what I do to keep the queen out of my supers if I do not use queen excluders, right.
I monitor the location of my queens. This is why, in early spring, I rotate my two deep hive bodies. I want to work the queen down to the bottom of the hive as she typically will work her way up. Coming out of winter the bottom deep brood hive body is usually empty, and so by placing the queen below 10 frames of empty drawn comb, she can begin lying with plenty of room and this will slow her movement to the upper honey super. So, an experience beekeeper can keep an eye on the queen and move her back down as he see fit. Here's an illustration I drew up to help you see how to rotate your hive bodies in the spring.

On the other hand, a new beekeeper may not want to monitor and reposition the queen, or rotate the hive bodies so in this case, a queen excluder is a good practice. If you'd like to purchase a queen excluder, you can do so by clicking here to go to our website: **honeybeesonline.com**. Time of inserting is no constant. It various place to place within the same seasons. But beekeepers consider the present of bee forage at next time.

Even bee forage punt also considered .most of **September to October in** queen **excluder** between box. Add supers to those for bee. Harvest honey as mid September. Make harvest at end of And in late October also. swarm.



objective of bee keeper the time in Ethiopia From **some area June** Place the first and second super needing additional space early harvest from all at another round honey September, early October, Expect reproductive

- In dray period beekeepers reduce honey champers so they remove queen excluders. Check if all the colonies are under shade and how close to each other.

In cooler area, beekeepers who can choose when they open their hives should work on a warm, dry, windless, sunny day; when most of the older bees are not inside the hive. In any case, hives should not be opened during cold temperature, windy and rainy days when all the foragers are inside the hives. Bees are especially likely to sting when there is no nectar flow. Colony conditions which make the bees more difficult to handle include: a very large population, presence of many old bees, previously alerting of the colony by disturbances of any kind, robbing by bees from other colonies, queen less or super reducer, and starvation.

Always wear protective clothing. Open the hive when necessary, and then as briefly as possible. Always work at the back of a hive, away from the bees' flight paths in front of the hive entrance. All movement should be smooth and deliberate, not jerky or rough. Do not bump or jar hives of frames. Keep boxes of frames of bees covered, to reduce the number of bees flying and to prevent robbing; manipulating cloth can be useful for this purpose.

The beekeeper should take into account the fact that bees react strongly to certain smells such as perspiration, alcohol, soap and perfume. Avoid carrying these strong smells. Do not keep animals near the bees. Since bees can be entangled in hair and woollen clothing, avoid wearing clothes made of these materials. Wear clothing of the lightest possible colour. When bees are aggressive they will always go for dark colours first.

Make sure that you have smoke when you want to open the hives. Always first blow the smoke at the flight entrance. Always make sure that you have enough fuel for the smoker at hand. If you have been stung you must kill the bee that has stung you and then scrape the sting out of your skin with a fingernail or a sharp object.

Self-Check -5	Choices Test

Directions: Answer all the questions listed below. Encircle the letter

1 On of the following is not the general rules for hive inspection (4point):

A .Look at each hive from a distance or from behind the hive entrance.

B .Start from weak colonies to strong colonies.

C. Start from strong colonies to strong colonies

D. Hive entrance should be clear, clean from dead bees, ants, termites and straw

Note: **Satisfactory rating – 4 points** **Unsatisfactory - below 4 and 4 points**

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

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Operational sheet	Makin Artificial foundation sheet

Step1, container is taken for the melting the wax and other tools

Step2, heat in a water bath to 68°-72°C.

Step3, Beeswax is add to the container until it is filled to about 5.0 cm of the brim.

Step4, A long glass/water proof ply board/ smooth piece of wood sheet of width a little narrower than the melting container is drop into the molten wax for about three seconds and then lifted out to cool

Step5, Thin sheets of wax form on each side of the glass are peel off and place on a flat surface to harden. This is soak in water for 24 hours before use

Step6, To facilitate the removal of the wax sheets from glass or wood, a weak solution of liquid washing soap is apply before dipping in the wax.

Step7, The sheets are passé one by one through a reeling mill which is hand /electric operated.

Step8, The rollers press the sheets to a uniform size and thickness and embossed hexagonal impression

Step9, Separate rollers are used for making comb foundation for

Apis cerana indica and A .mellifera

LAP Test	Practical Demonstration

Name: _____ Date: _____

Time started: _____ Time finished: _____

Instructions: Given necessary templates, tools and materials you are required to perform the following tasks within 8-12 hours.

Task 1: Make Artificial foundation sheet using wax mold.(5point)

Task 2: Identifying Inspection techniques of bee colony.(5point)

Task 3: Explaining techniques of Bees handling.(5point)

Instructions: write the appropriate answer for the following questions

3. Demonstrate external and internal inspection of honey bee colony .(5point)
4. Collect equipments that are used to make foundation sheet .(5point)
5. Handle equipments that are used to make foundation sheet .(5point)

List of Reference Materials

- Deliverable: Manual on Beehive Construction and Operation University of Kassel (UNI KASSEL)Date:15-June 2018
- BEEGIN BEEHIVE MATERIALS RESEARCH SUMMARY Ivan Leroy Brown M Tech Industrial Design November 2018
- ADVANCED BEEKEEPING MANUAL Ethiopian beekeeper association JUNE 2011