BEEKEEPING Level -1

Learning Guide -1

Unit of Competence: Select and Establish Apiary
Module Title: Selecting and Establishing Apiary
LG Code: AGR BKG1 M09-L01-LG1

TTLM Code: AGR BKG1 TTLM 0919v1

LO 1: Identifying requirements to establish apiary

Instruction Sheet	Learning Guide #-1

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

- Discussing establish apiary sites
- Understanding colonies of honeybees
- Identifying basic *equipment, materials and tools* require establishing apiary.
- Describing way to clear and fencing apiary site

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**

- Discuss establish apiary sites
- Understands colonies of honeybees
- Identify basic *equipment, materials and tools* require establishing apiary.
- Describe way to clear and fencing apiary site

Learning Instructions:

1. Read the specific objectives of this Learning Guide.
2. Follow the instructions described in number 3 to 7.
3. Read the information written in the "Information Sheets Try to understand what are being discussed. Ask you teacher for assistance if you have hard time understanding them.
4. Accomplish the "All Self-check
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 other "Information Sheet". However, if your rating is unsatisfactory, see your teacher for further instructions or go back to Learning Activity #1.
7. Submit your accomplished Self-check. This will form part of your training portfolio.

Information Sheet-1	Discussing establish apiary sites

1.1.Defintion of 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.

1.2.**Important in site selection**

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.

1.3. 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**.**

Self-Check -1	Written Test

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

1. How can prepare the selected area before installation of hives? 20PTS

2. What are conditions considering select a suitable location? 10

3. What is the important site selection**?10**

Note: **Satisfactory rating - 40 points** **Unsatisfactory - below 40 points**

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions

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Information Sheet-2	Understanding colonies of honeybees

2.1. The Honey Bee Colony

Under normal conditions a honeybee colony consists of one queen (reproductive female), several thousand workers (unmated females) and depending on the season, a few to several hundred drones (males). The sex of a honeybee is determined by egg fertilization; generally, fertilized eggs develop in to females and non-fertilized eggs develop in to males. During mating, a queen receives a supply of several million spermatozoa that are stored in the sperm theca, a small spherical organ that is connected to the oviduct by its own small duct. The queen, by releasing or withholding spermatozoa from the sperm duct as an egg passes down the oviduct, is able to selectively fertilize or not fertilize eggs. Adult workers and queens both develop from fertilized eggs but they are distinct in both their anatomy and behaviour. Normally the queen the main egg layer. Therefore, all of the other bees are her offspring. Workers do not usually lay eggs but, if they do, drones, not workers, are produced. In nature, a queen less colony that develops laying workers usually dies. Workers perform most of the tasks in a colony. These include activities such as comb building, hive cleaning, feeding and caring for larvae, feeding and grooming the queen, foraging and colony defense.

Differences in anatomical and behavioural characteristics between adult workers and queens are the result of the food that each receives during larval development. Larvae that are being reared as queens receive a surplus of a special type of food called “royal jelly” throughout their development. Larvae being reared as workers receive royal jelly for only three days after hatching; following this their food is mixed with pollen and nectar from flowers.

A colony of honeybee has been likened to a “super organism”. The behaviour and biology of all its members is directed towards the survival of the colony, not the individual. Although workers and drones live a few months at most and queens for two to three years on average, a colony can survive much longer because its individuals are constantly being replaced. The social order of a colony results in a behaviour more like that of a single organism than a group of individuals.

*2.1. **The Queen***

There is only one queen in the hive. She is recognized by her long abdomen, which extends far beyond the tip of her wing in the resting position. Her thorax is larger than that of the worker. Viewed from the front, her head is round. The queen has a sting but is only used to fight rival queens. She has no collecting apparatus like pollen basket, long proboscis for drawing nectar or wax glands to secrete wax to build comb cells. As a queen, she usually does not feed herself.

Immediately after the queen emerges, the queen tours the hive to see if there is any rival queen hiding somewhere. If she finds one the two queens will fight until one is killed. Five days after the queen emerges from her cell she starts fly out of the hive, making an orientation flight of about five minutes. Next she makes mating flight, which lasts about 30 minutes. She flies to an area 6-10m above the ground where many of the drones are present. If successful mating flight, she is mate by about 8-10 drones. A well-inseminated queen carries about 5,000,000 spermatozoa. The type of flight that the queen makes for mating purpose is called nuptial flight. When the young queen keeps unmated for long period she will start to lay unfertilized eggs in worker cells. From these eggs, only drones develop.

New queens are produced under three circumstances: a. when the colony is planning a reproductive swarming, the bees build 10-20 royal cells, and the original queen lays an egg in each. The new queens born after the old queen has departed with the swarm; b. when the queen is over0-aged and lying badly, or is otherwise failing, the workers build 1-3 replacement or supersedure queen, lives together in the hive with the old queen for a certain time; c. when the colony loses its queen through accident or disease the workers create emergency queen cells from workers cells containing larvae less than three days old, situated at the central strip of the comb.

Table 1. Adult life stages recorded for queens of some races of Apis mellifera.

Apis mellifera	Emerge	Days of first flight	Day mating occurs	Day egg laying starts
Temperate zone	0	5-6	6-9	8-13
Tropical zone	0		5-6	7-9

A good queen lays from 1500 to 2000 eggs a day, and she lives for up to five years, but her best laying period is during her first two years only.

Pheromone ones produced by the queen are largely responsible for the coherence of a "{queen right colony" the fact that the adult bees stay together as a social unit. In queen right colonies pheromone production from the mandibular glands is greatest in young mated and laying queens, and colonies headed by such queens are least likely to supersede their queens

to swarm.

Young workers feed the laying queen, and repeatedly lick her body and brush over it with the antennae. By so doing the workers obtain some amount of pheromones; these pheromones are the translocated on the body surface of each individual bee, and they also spread it by grooming her body. Subsequently she moves around among other bees in the colony, by making physical contacts these other workers obtain a share of pheromone. With the result that all are aware of the queen's presence, it is likely that 9-oxa-decenoic acid is the main queen presence signal within the colony.

The adult queen emerges from the cell 16 days after deposition of egg.

*2.3. **The Drones***

The drones are the colony members that show a high degree of laziness. His presence in the hive is of little importance except for mating purpose may also play a small part in raising the temperature A drone is much more broader than a worker but shorter than a queen. The abdomen is not pointed. Their compound eyes, at the top of the head, are twice as large as those of the queen and the workers, and their wings are the largest of those of the three castes; these differences help them to locate the queen in the air and to catch her during the mating flight. Drone has no suitable proboscis for gathering nectar and has no sting to defend itself or the colony. He has no pollen basket and glands to secret wax for comb construction.

The drones emerge 24 days after egg deposition and become sexually mature within 9-12 days or older.

Drones release a special pheromone into the air at a congregation site to attract queens as well as other drones to the site, and when a queen enters the site many drones approach her.

Workers control the number of drone in a colony. The extent of drone rearing is very variable, but it is a feature of strong colonies, of colonies nearing the culmination of their population growth, and of prime swarms after 3 weeks in their new nest or hive. In both colonies, in the wild and those traditional hives, workers can increase drone rearing by building more drone cells. The bees seem to restrict the total number of the drones in the colony, although the mechanism is not well understood.

In queen right colonies, normal mortality of the drone brood is always higher than that of the workers brood. In general, brood mortality was lower in colonies with a good pollen supply or to which pollen combs were given. It was highest in the early larval stage.Workers also limit the total number of adult drone in their colony. They can restrict the total population of the drones by reducing the number neared when there are already many in the colony, and by not feeding adult drones.

*2.4. **Workers***

Workers are the smallest and most numerous of the bees. Viewed from the front the workers have a triangular shape. The tips of her wings in the rest position cover the end of her abdomen.

The workers are females whose reproductive organs are atrophied; they cannot be fertilized by the drones, as they do not posses sperm reserve capacity. On the other hand, they have organs other than those of the queens and the drones, to enable them to execute all duties in the colony. Their tongue is longer than that of the other caste, to enable them to suck nectar from flowers; they have a special sac for carrying honey and water, pollen basket for carrying pollen, a well developed sting, Their heads contains glands producing royal jelly, salivary gland in the thorax produce enzymes which ripens the honey; and four pairs of wax glands to produce wax.

A large colony can consist of more than 50 000 workers. Workers perform different kinds of work within and outside the colon depending upon her age. Workers live entirely within the colony during the early part of their life, they are negatively photo static, shunning, and the light outside. They are at this stage sometimes referred to as House bees and carry out a number of activities that are needed to maintain the well being of the colony such duties include: preparing brood food, for defence, building up of the comb with wax. As House bees become older, they are driven gradually out from the brood nest by the pressure of the emergence of new workers.

Worker bees have secretary glands. Different glands have their greatest activity at different periods in the life of an individual worker, although condition within the colony and outside it influence the exact age of the bee when the glands are active. Quite commonly, brood food is secreted by relatively young workers, bees wax by slightly older ones, enzymes require for converting nectar into honey, and for synthesis of venom, are elaborated later.

Self-Check -2	Written Test

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

1. What is bee colony?
2. What is the function of queen bee
3. What is the function of drones?
4. What is the function of workers bee

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

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions

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Information Sheet-3	Identifying basic *equipment, materials and tools* require to establish apiary

3.1.Beekeeping equipment and Tools:

Beekeeping equipments are materials used in beekeeping and honey production.

Besides the hive, there are several pieces of equipment that are indispensable for beekeeping. If a person is to work with bees successfully, there should be some protection from bee stings. Protective clothing worn by the beekeeper prevents most stings. A smoker when properly used allows for some control over the bees, thus minimizing stings .A hive tool allows the beekeeper to pry top bars.

Veil: is the minimum piece of protective clothing and can be made of metal or plastic screen, of nylon mesh or frames apart gently, minimizing disturbance to the bees .All of these things can be made by local tailors and tinsmiths. Or of mosquito netting. They are usually made to fit over a wide brim hat, which serves to hold them away from the face and neck. Elastic, rubber bands, or strips cut from an old tire tube can be used to hold them onto the hat.

Gloves: can be made of leather or of heavy, light-colored cloth. Gauntlets that reach the elbow and have elastic to hold them tight give protection to the wrists.

Clothing: should be loose-fitting and of light- colored, smooth-textured material. Bees are less attracted to light colors. They tend to get tangled in fuzzy material, which often causes them to sting.

Smoker: is used to produce smoke, which causes the bees to consume honey, reducing their tendency to fly and sting. Smoke also directs bees away from areas of the hive being worked. The smoker consists of a firebox with a grate to hold the smoldering material, a nozzle to direct the smoke, and a bellows. The firebox should hold enough fuel so that it does not have to be refilled frequently when working with the bees.

Sprayer: Water can be used along with smoke to help control highly defensive bees or those that run excessively on the combs. A spray bottle works best, though a squirt bottle or a container with holes in it can be used. The objective is just to wet the bees, not to drown them.

Hive tool: is a piece of flat metal used for prying the parts of the hive apart and for scraping away the excess propolis

and wax. Some hive tools have a bent end for scraping and a hole that can be used to remove nails. A local blacksmith can make a hive tool from a bar of hardened steel.

Casting mould: It is equipment, which is used to print foundation sheet artificially. It is coated with zinc. Its size depends on races of honeybees.

Queen excluder: Is a sheet of perforated wire grid that is placed between the brood chamber and honey chambers. It is a device used to form an appropriate partition between the brood and honey chambers so as to prevent the queen or drone from entering to honey chambers.

A queen excluder has the same cross-section as the hive, its holes (usually slots) being large enough to let the worker bees pass, but not the queen whose body is wider. It is placed above the hive box (es) that the beekeeper wants the bees to use as the brood nest, so that the boxes above (the honey supers) are kept free from brood.

The correct slot width for queen excluders depends on the queen's body size. Slots from 4.14 to 4.5 mm wide are used for European A. mellifera. A single slight distortion in an excluder can let the queen through, and excluders should therefore be stored in a flat pile, in a place where they will not be disturbed.

Honey extractor: It can be manually or electrically operated.

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

Wax extractor: Is used to separate wax from old brood combs and other impurities.

Honey sieve: Is a material that enables to separate honey from pollen, wax and other impurities. All honey as it comes from honey extractor and before it goes into honey jars should run through a strainer.

Uncapping fork: Is a material used to decap the cells of sealed honeycomb before the frame combs are placed in the honey extractor.

Transformer: It is an electrical device having 18-24 volts and is used to fix the foundation sheet to frame wires. It converts 220 volts of electricity to 18-24 volts. In the absence of electricity, wax embedder (knife or hot wire) can be used.

Self-Check 3	Written Test

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

1. List types of bee equipment and tools 10PTS
2. What is honey sieve?5PTS
3. Explain about queen excluder 5PTS

Note: **Satisfactory rating - 20points** **Unsatisfactory - below 20 points**

Answer Sheet

Name: _____ Date: _____

Score = _____

Rating: _____

Short Answer Questions

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Information Sheet-4	Describing way to clear and fencing apiary site

Clear and fencing apiary site

Planting sapling suitable for edge vegetation or fencing can mark the boundary.

Survey the given area for the location of suitable condition as detailed in the theory. Measure a suitable size of the land based on the number of colonies planned to be hived and the size of the honey house to be constructed. Level the land and make rainwater drain to avoid, water logging during the rainy season. Undertake soil treatment if there is the problem of ants and termites. Erect The fence according to the needs of the site selected. Some selected bee flora can be propagated in and around the apiary. The honey house can construct in the direction of the wind and away from the foraging path of the bees.

PROCEDURE

Clear the ground, where the proposal for installing the modern beehive is to be done.

Make the ground even and remove grass and other vegetation from the area of hive installation. Install the hive stand; check the firmness of the stand, if it is stable it suitable to install the brood hive on the stand. If not place suitable piece of stone under the leg, which is not grounding properly.

Now arrange the frame inside the brood hive. Check the bee space if it not uniform at all the positions of the hive, rearrange the frames in such a way the space between the frames and the body of the hive. After making the final arrangement numbers of the frames in an order. Next remove the frames and wire them, care should be taken to hammer the nails into the frames so that there is no projections. The frames are now ready for fixing comb foundation sheets. Next fix the queen gate to the hive entrance. Install the brood hive onto the hive stand. The modern hive is ready for hiving the bee colony. Multiple hive installation is done in linear, semicircular or in cross design. Design of installation is influenced by forage distribution and type of shelter in and around the apiary.

Self-Check 4	Written Test

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

1. How can fencing apiary site
2. Procedure to installing modern hive

Note: **Satisfactory rating - 2points** **Unsatisfactory - below 2points**

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions

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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 hour.

Task 1. Prepare the selected area before installation of hives

Operation Sheet- 1	Techniques of identifying queen from other bee

Techniques to follow

Step 1- long abdomen,

Step 2 thorax is larger than that of the worker

Step 3 Viewed from the front, her head is round

Step 4 She has no collecting apparatus like pollen basket

Step 5 long proboscis

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BEEKEEPING Level -1

Learning Guide -2

Unit of Competence: - Select and Establish Apiary site

Module Title: - Selecting and Establishing Apiary site

LG Code: AGR BKG1 M09-L02-LG2

TTLM Code: AGR BKG1 TTLM 0919v1

LO 2: Identifying criteria for apiary site selection

Instruction Sheet	Learning Guide #-3

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

- *Identifying Criteria* for selecting a site
- Determining flora to support desired number of hives at site
- selecting locality a potential site in using site selection criteria

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

- *Identify Criteria* for selecting a site
- Determine flora to support desired number of hives at site
- select locality a potential site in using site selection criteria

Learning Instructions:

1. Read the specific objectives of this Learning Guide.
2. Follow each instructions described
3. Read the information written in the "Information Sheets". Try to understand what are being discussed. Ask you teacher for assistance if you have hard time understanding them.
4. Accomplish the "All Self-check"
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 other "Information Sheet". However, if your rating is unsatisfactory, see your teacher for further instructions or go back to Learning Activity #1.
7. Submit your accomplished Self-check. This will form part of your training portfolio.

Information Sheet-1	*Identifying Criteria* **for selecting a site**

1.1. Apiary sitting

A good apiary management starts with choosing a good site to hang or place hives. If you choose a poor site people and animals may be stung. If the site is insecure honey and hives can be stolen. The following are recommended practices for a good apiary site:-

- The site must be easy to get to and from in order for you to check the hives regularly.
- An apiary can house up to 20 hives depending on the availability of flowering trees in the area as bees forage up to 3 km from the apiary.
- A high hedge or fence should be put around the apiary to separate the bees from people and animals, as bees can be aggressive. The apiary should be away from human and livestock dwelling areas, roads and public areas.
- It should be safe from strong direct sunshine, be shaded during the hot part of the day but have sun in the morning. Shade must be constructed if none is available at the site.
- It should be safe from strong direct wind and allow good air circulation.
- It must be near a fresh water supply; this can be a river, pond or even a dripping tap.
- It must be near food sources such as trees/nectar bearing crops, and cash crops that need pollination.
- Putting hives in a bee house/shed, which can be locked to prevent thieves stealing the honey, is one option. But there must be holes in the wall to allow the bees to get enough fresh air in and out of their hives.
- It is better if the apiary is away from areas where children play or any source of continual noise.
- Noise can disturb the bees and make them defensive.
- The apiary should be on higher ground, away from marsh or land liable to possible flooding. Humid conditions encourage fungal growth and prevent honey maturing and bees from foraging.
- The apiary must not be close to areas where pesticides are used as they may kill the bees and contaminate the honey.
- The bees will also appreciate being away from smoke, fire and unfriendly neighbors'.
- There should be good water not contaminated one.
- Should not be near the road.

- ❖ Should be near good plantation like coffee plantations.

Remember that once the bees enter the hives it will be more difficult to change things so choosing a good site to begin with is most important!

1.2. Select a suitable location, considering the following conditions

- ➢ Sunrise set
- ➢ Wind direction
- ➢ Away human settlements
- ➢ Free from air and water pollution
- ➢ Free from bee diseases
- ➢ Provision/presence of clean water source

Self-Check 1	Written Test

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

1. What are recommended practices for a good apiary site:-

2. How can select a suitable location

Note: **Satisfactory rating - 2points** **Unsatisfactory - below 2points**

Answer Sheet

Name: _____ Date: _____

Score = _____

Rating: _____

Short Answer Questions

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Information Sheet-2	Determining flora to support desired number of hives at site

1.1 **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.

1.2. 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 behaviour 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 refractometer.
- 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.

Self-Check 2	Written Test

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

1. What is Honeybee Plants? 5PTS

2. What is Floral Calendars? 5pts

Note: **Satisfactory rating - 2points** **Unsatisfactory - below 2points**

Answer Sheet

Name: _____ Date: _____

Score = _____

Rating: _____

Short Answer Questions

1._____
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2._____
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Information Sheet-3	selecting locality a potential site in using site selection criteria

Apiary Site Selection

Choosing a place is comparable to finding a home foryourself.

- Sort out what you want against what is possible.
- It will always be a compromise.
- Hopefully we will help you make a good choice and avoid some of the pitfalls.
  Good Luck!

Factors to be considered in selecting an Apiary site:

- Is there convenient access, with minimal carrying for the beekeeper to bring in equipment and remove honey supers?
- Is the **space** suitable for the number Will the site cause a nuisance to neighbors or the general **public?** Is it safe from vandals?
- Is there **forage** for the honeybees? Are there any apiaries nearby?
- Is the **environment** of the site suitable for bees? Of hives?
  Consideration for the public
  - The general public is often ignorant and frightened.
  - If they become alarmed about the beehives, their complaints can result in your bees being considered a'nuisance' with the consequent loss of apiary sites foryourself and other beekeepers.
  - Bees establish regular 'flight paths' en route toadjacent forage.
  - Enclosing an apiary with hedges or a trellis is good practice.
  - Also reduces the visibility of beekeeper activity
  - Avoid sites which border roads or public paths.
  - Keep only good-tempered bees. Culling bad tempered stock and replace.

- Damage to hives from thieves and vandals can occur.
- Out of sight out of mind is a good maxim.

Forage

- Honeybees mostly forage for nectar and pollen within 2-3 miles.
- An apiary site may be permanent or temporary to exploit a crop or seasonal sources.
- Farmland may provide an excellent source for a month.
- Gardens are usually planted with flowering plants, shrubs and trees that bloom from April to September.
- An apiary within flying range of these but sited in an area of low population density can be ideal
  - Find out the location and size of other apiaries that provide competition for forage.
  - Talk to members of your local association.
  - Generally no problems with small numbers of hives and vast farm crops but field margins and gardens provide much smaller though continuous forage.
  - It is sensible not to compete with large beekeepers.
- **Environment**
  - The hives should be sheltered from the prevailing wind, so that foragers can land easily at the hive entrance and roofs are not blown off in gales. Avoid sites open to cold northerly or easterly wind.
  - A generally southerly aspect will provide warm and dry conditions, especially helpful in winter.

- Avoid sites in a frost pocket, which will affect spring development, or on low or damp ground that could become floodedSites under trees are unsuitable because they are usually damp.
- The area should be fenced from livestock that may kick over hives.
- Bees need water If this is not naturally available then consideration should be given to providing a suitable source, away from the main flight paths to avoid fouling.
- You may find it helpful to discuss potential sites with your local bee inspector, who can advise if there are any disease problems in the area.

Access

Convenient access is essential.

Easy movement of equipment in and out of the apiary.

Adding and removing supers, controlling swarming, feeding and treating the colonies is not physically demanding or

Environment

Sites under trees are unsuitable because they are usually damp.

The area should be fenced from livestock that may kick over hives.

Bees need water If this is not naturally available then consideration should be given to providing a suitable source, away from the main flight paths to avoid fouling.

You may find it helpful to discuss potential sites with your local bee inspector, who can advise if there are any disease problems in the area.

Access

Convenient access is essential.

Easy movement of equipment in and out of the apiary.

Adding and removing supers, controlling swarming, feeding and treating the colonies is not physically demanding or hazardous **Access**

Do not consider a site that entails climbing fences or crossing ditches to enter. It is ideal to have vehicular access right up to the hives when necessary. Remember, dry grassland may become impassable mud in wet weather.

A level site is easier to manage

Space

- Guidelines when making the plan:
- Easy access to manipulate the colonies without working in the flight paths.
- Work the frames in the hive across your body from where you plan to stand.
- Space to stack the removed supers and roof without the beekeeper moving away from the hive.
- Placing the hives on stands about 12-15 inches above the grounds makes for a comfortable working height for the beekeeper.
- It is better to put more distance between your hives

Finding the site

- Establishing good relationship with neighbors, local farmers, landowners and the general public is a major factor in finding and maintaining a successful site for your bees.
- Talk to them about the value of bees as pollinators; educate them about swarms, flight paths etc. Try to capture their interest and co-operation, gaining respect for the bees and the beekeeper.
- Most beekeepers are tempted by the familiar and convenient location of their **own garden**, but small gardens, particularly those surrounded by houses are not likely to be a successful solution. With careful management a small garden in open countryside or a garden at least the size of a tennis court could provide a suitable site for two or three hives

Situations to avoid

- A small suburban garden, adjacent to areas where children play may cause instant complaints.
  - A cloud of roaring bees swarming into a neighbor'sgarden.
  - Bees drinking at neighbor's birdbaths or garden ponds.
  - Bees soiling the neighbors wash as they make their cleansing flights in early spring.
  - A hive on a flat and possibly slippery roof accessible either by ladder or through an upstairs

Self-Check 2	Written Test

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

1. Factors to be considered in selecting an Apiary site?

2. What is forage?

Note: **Satisfactory rating - 2points** **Unsatisfactory - below 2points**

Answer Sheet

Name: _____ Date: _____

Score = _____

Rating: _____

Short Answer Questions

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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 3 hour

Task 1. How can select a suitable location, for apiary site?

Operation Sheet- 1	Techniques of Selection of good apiary site

Techniques to follow

Step 1- Apiary ground should be clean & free from dry leaves etc. to avoid fire during summer

Step 2 Apiary site should be away from power station, brick kilns, highway and train tracks

Step 3 Site should be open & at dry place having shade

Step 4 Site should be easily accessible by road

Step 5 Fresh running water should be easily available near the apiary

Step 6 It should have natural / artificial wind breaks

Step 7 Site should receive early morning and afternoon sunshine

Step 8 Area should be rich in bee flora

Step 9 There should not be other commercial apiary within 2-3 kilometers from the apiary site

Step 10 There should not be any source of stagnant / dirty water, chemical industry/ sugar mill, etc., nearby the apiary

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BEEKEEPING LEVEL -1

LEARNING GUIDE -3

UNIT OF COMPETENCE: SELECT AND ESTABLISH APIARY
MODULE TITLE: SELECTING AND ESTABLISHING APIARY
LG CODE: AGR BKG1 M09-L03-LG3

TTLM CODE: AGR BKG1 TTLM 0919V1

LO 3: .IDENTIFYING HONEY BEE FLORA

Instruction Sheet	Learning Guide #-3

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

- ✓ Identifying Types of honey bee floras
- ✓ Identifying Season of honey bee flora
- ✓ Identifying Ethiopian honey bee flora

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

- ✓ Identify Types of honey bee floras
- ✓ Identify Season of honey bee flora
- ✓ Identify Ethiopian honey bee flora

Learning Instructions:

1. Read the specific objectives of this Learning Guide.
2. Follow each instructions described
3. Read the information written in the "Information Sheets". Try to understand what are being discussed. Ask you teacher for assistance if you have hard time understanding them.
4. Accomplish the "All Self-check"
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 other "Information Sheet". However, if your rating is unsatisfactory, see your teacher for further instructions or go back to Learning Activity #1.
7. Submit your accomplished Self-check. This will form part of your training portfolio.

Information Sheet-1	Identifying Types of honey bee floras

Identifying Types of honey bee floras

The bees are usually attracted towards the flower. The flowers are of three types based on the sex. The male flower (staminate) The female flower pistillate and bisexual flower . The flower may be solitary or they may be arranged in the inflorescence.

Cross section of typical bisexual flower

The pollen grains are produced in the anther, these are the male gamete. The pollen grains of insect pollinated plants are big in size and have rough sticky surface. Whereas wind pollinated flowers produce small, powdery and number of pollen grains.

The nectar glands are located usually deep inside the flower between the ovary and corolla. These are floral nectarines (floral nectar) and some plants have nectaries outside the flower, on leaves other parts of plants, extra floral nectarines (Extra floral nectar

Those plants which provide forage resource to bees are known as bee flora. Other plants may also produce the resource but they may not be available for the bees. Ethiopia has over 500 species of plants (Cultivated and wild) which provide forage resource to bee. If these forage source is not utilized properly it leads to wastage of natural resource (pollen nectar and resins)

Classification

Plants can be grouped under respective families genus/ species based on there taxonomic feature. The honey bee flora is also classified based on the type of forage the plants provide.

The plant which provides nectar only are known as nectar yielders.

The plants which provide pollen and nectar are known as nectar and pollen yielders. Non flowering plants are useful to bee, as they collect resins from species, of plants.

The bee flora **is classified as** major and minor source, based on the production of the resources and collection of these resources by the honey bee.

1. POLLEN YEILDERS Some plants provide pollen to the bees. These are known as pollen yielder. The pollen yielder can be classified as major and minor source based on the forager attendance over a period of time. Setting a pollen trap in front of the hive entrance can also do it. Then the relative weight of the different pollen is useful in classifying plants as: major source (Stereospermum kunthianum, Prunus persica, Hagenia abyssinica). Minor source (Eucalyptus citriodoria).
2. NECTAR YIELDER Some plants provide nectar to bees. These are known as nectar yielder, they can be classified as major and minor based on the amount of nectar and the concentration of sugar in the nectar.(Major source Balanites aegyptiaca, Adansonia digitata) (Minor source Acacia polyacantha).
3. POLLEN AND NECTAR YIELDER Some plants provide both pollen and nectar to bees. The plants may provide abundant nectar and some pollen. OR . They may provide abundant pollen and some nectar. OR. They may provide abundant / less pollen and nectar. (Eucalyptus citriodora, Hypericum revolutum, Syzygium guineense, Ceiba pentandra)

The areas can be assessed as useful zones for promoting beekeeping activity, as aprofitable agricultural occupation. Occurrence of few wild colonies here and there need not necessarily mean the area is suitable for intensive beekeeping activity.

The under mentioned information are useful in surveying and evaluation of potential beekeeping area.

1. Refer to published floral calander of other countries with similar vegetation patterns, agro-ecosystem, climatic and edaphic factors. Whether similar conditions are present or not will decide the suitable plants for the region under considersation.
2. Seasonal occurrence of large wild colonies in an area indicates that good forage source is available in that area
3. Few trees or few hectares of bee flora, alone is not enough to decide that the area is suitable for beekeeping.

4. Commercial beekeeping activity requires thousands of hectares of land, close by providing forage to bees. Relatively long flowering period plants are good honey source. The length and width of land should be proportionate, to increase foraging efficiency. Uneven size of land decreases foraging efficiency.The colonies should weighed regularly to know productivity. The economic return depends on the price of hive products in the area.
5. The colour and scent of flower may not be attractive to bee. Those plants may not be important to bees.
6. Large-scale plantation of honey bee flora may not yield good results. Usually the bee flora should be propagated along with crop species, roadside, social forestry and waste land development.

Self-Check 1	Written Test

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

1write classification of honey bee flora?

2. Mentioned information that useful in surveying and evaluation of potential beekeeping area.?

Note: **Satisfactory rating - 2points** **Unsatisfactory - below 2points**

Score = _____

Rating: _____

Answer Sheet

Name: _____ Date: _____

Short Answer Questions

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Information Sheet-2	. Identify Season of honey bee flora

Identify Season of honey bee flora

Floral calendar is an important tool for beekeeper; it indicates various information of an area. This information is an important tool to plan beekeeping activity. It indicates the beekeeper the date, time and period of flowering in an area. Through experience beekeeper knows the major flowering periods of his area. Charts are published from many parts of the world. The floral calendar is an useful tool to the apiculture extension worker. Beekeeping depends much on floral calendar of an area. It is also useful if one has to take up migratory beekeeping.

The following steps are undertaken to design a floral calendar:

Survey to be taken up in the area and to make a list of plants and also to observe the flowering density.

1. Estimate food shortage increase/decrease in weight by weighing the hive periodically.
2. List the plant species visited by bees within its foraging range (mellifera-1 Km).
3. Identify the plants as pollen /nectar yielder.
4. Study the frequency of bee visit to plants. If there is no increase or decrease in weight , it is useful only in maintaining the colony. If there is increase in colony weight, the plant species is major source, useful in production.
5. Carefully record all the changes in flowering of plants visited, by bees.

Bee flora calendar

Name of plant	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
Bhindi			*	*		*	*	*			
Bitter gourd						*	*	*	*		
Brinjal			*	*	*	*			*	*	*
Onion	*	*	*	*	*						
Kate math									*	*	
Methi	*	*	*	*							
Garlic								*	*		
Cucumber								*	*	*	
Garden pea									*	*	*
Bottle gourd								*	*		
Pumpkin								*	*	*	
Silk gourd							*	*	*	*	
Cluster bean						*	*	*			
Drumstick	*	*	*	*							*
Muli	*	*	*	*	*	*	*	*	*	*	*
Coriander	*	*	*	*	*	*	*	*	*	*	*
Cauliflower	*	*	*	*							

Curry patta			*	*	*						
Water melon		*	*								
Guava						*	*	*	*		
Banana	*	*	*	*	*	*	*	*	*	*	*
Custard apple						*	*	*			
Pomegranate			*	*	*	*					
Orange	*	*	*			*	*				
Ber[1]					*	*	*	*	*	*	
Bel					*	*					
Mango	*	*	*	*							
Papaya		*	*								
Ale	*	*									*
Jackfruit		*	*								
Lemon	*						*	*	*	*	*
Kaghziinimboo	*	*	*								*

nariya	*	*	*	*	*	*	*	*	*	*	*	*
Amla			*	*	*							
Chick	*	*	*									*
Moon								*	*			
Pigeon							*	*	*	*		
Urd black gram								*	*			
cow							*	*				
Whea	*	*	*	*								
Maiz		*	*					*	*			
Rice									*	*		
Jowa		*	*									
Cotto									*	*	*	*
Ground				*	*	*	*	*	*	*		
Soybe							*	*	*	*		
Sunflow								*	*			
Sesa							*	*	*			
Casto	*	*									*	*
Tulsi			#	#			#	#	#			
Basil	#	#								#	#	#
Ros			#	#	#	#	#	#	#			
Marigol									#	#	#	#
Adhuls	#	#	#	#	#	#	#	#	#	#	#	#
Kalmeg				#	#	#	#					
Shatav					#	#						
Brahm						#	#	#	#	#		
Ashok		#	#	#								
Gul			#	#	#							
Malti				#	#	#	#					
Kena					#	#	#	#				
Tamarin	x			x	x							X
Nee			x	x	x							
Eucalypt	x	x	x								x	X
Jamu			x	x	x							
Pala		x	x	x								

Kachnar	x	x										
Apta			x	x	x	x	x	x				
Khair									x	x	x	X
White siris tree				x	x							
Kadam	x	x	x									
Sema	x	x	x	x	x							
Rui											x	X
Bahav				x	x							
Lantan	x	x	x	x			x	x	x			
Nimbar		x	x	x	x							
Sham					x	x			x	x		
Arjun				x	x							
Ekdan	x	x	x	x	x	x	x	x	x	x	x	X
Squirrel	x	x	x	x	x	x	x	x	x	x	x	X
Devil's Horsewhip	x	x										X
Cobbler's pegs							x	x				
Janglim	x	x	x									X
Bold-leaf Launaeae									x	x	x	X
Wild			x	x	x	x	x					
Indian catmint	x	x	x								x	X
Flannel Plant	x	x									x	X
Anisee									x	x	x	X
Touch me not	x	x	x	x	x		x	x	x	x	x	X
Milk		x	x									
Karan		x	x	x	x							

* cultivated plants; #ornamental plants, x wild plant

Self-Check 2	Written Test

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

1. **Write season of honey bee flora**

2. write steps are undertaken to design a floral calendar?

Note: **Satisfactory rating - 2points** **Unsatisfactory - below 2points**

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions

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2. _____

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Information Sheet-3	. Identifying Ethiopian honey bee flora

Identifying Ethiopian honey bee flora

Important Honeybee Plants of Ethiopia

Table

Botanical name	Common name	Propagation	Apicultural use
Opuntiaficus 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

LAP Test	Written test

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

1. Write types of honey bee flora

2. Classifies honey bee flora based on nectar or pollen

Note: **Satisfactory rating - 2points** **Unsatisfactory - below 2points**

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions

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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 --- hour.

Task 1. Classifies honey bee flora based on nectar or pollen

Task . Write types of honey bee flora

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