



ANIMAL PRODUCTION

Level –III

Based on March, 2018, Version 3 Occupational standards (OS)



Module Title: Participating in Beekeeping Activities

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Table of content	pages
LO 1: ESTABLISH AND MONITOR QUEEN REARING AND RE- QUEEN HONEY BEE	6
INSTRUCTION SHEET	6
Information sheet 1 Obtaining and confirming tools, equipment, PPE and other requirements	8
Self-Check -1	10
Information sheet 2- Selecting Breeding stock.....	11
Self-Check -2	13
Information sheet 3- Selecting Day-old larvae.....	14
Self-Check -3	16
Information sheet 4-Transferring ripe queen cells into the nucleus 10-11 days.....	17
Self-Check – 4	18
Information sheet 5- Assessing vigor of the current queen.....	19
Self-Check – 5	20
Information sheet 6- Monitoring queen replacement signs of colony	21
Self-Check – 6	22
Information sheet 7- Monitoring replacement queens	23
Self-Check – 7	24
Information sheet 8- Raising Queen Bee from a nucleus colony and re queen the colony.....	25
Self-Check – 8	28
Information sheet 9- Monitoring hive.....	29
Self-Check – 9	30
Operation sheet 1.....	31
Operation sheet 2.....	32
Operation sheet 3.....	33
LAP Test	34
LO2. MANIPULATE HONEY BEE BROOD	35
INSTRUCTION SHEET	35
Information sheet 1- Selecting and checking tools and equipment.....	36
Self-Check – 1	37
Information sheet 2- Observing any site quarantine	38
Self-Check – 2	39
Information sheet 3- Identifying risks and taking actions	40
Self-Check – 3	41
Information sheet 4- Conducting hive inspection	42
Self-Check – 4	43
Information sheet 5- Monitoring hive and colony	44
Self-Check – 5	45
LO3. HANDLE HONEY BEE SWARM AND SWARMING BEHAVIOR	46
INSTRUCTION SHEET	46
Information sheet 1- Obtaining and confirming all equipment.....	47
Self-Check – 1	48
Information sheet 2- Placing dry drawn frames in hive box.....	49
Self-Check – 2	50
Information sheet 3- Monitoring signs swarming.....	51
Self-Check – 3	53



Information sheet 4- Identifying risks in handling bees	54
Self-Check – 4	54
Information sheet 5- Considering and monitoring swarming.....	55
Self-Check – 5	58
LO4. REMOVE HONEY CROPS FROM HIVE.....	59
INSTRUCTION SHEET	59
Information sheet 1- Obtaining and confirming tools and equipment	60
Self-Check – 1	62
Information sheet 2- Determining and monitoring ripeness/maturity of honey.....	63
Self-Check – 2	66
Information sheet 3- The impact of time and location during the removal of honey	67
Self-Check – 3	69
Information sheet 4- Using range of suitable methods for removing bees and honey.....	70
Self-Check – 4	72
Information sheet 5- Transporting honey-filled frames.....	73
Self-Check – 5	74
Information sheet 6- Checking moisture content of honey and storing	75
Self-Check – 6	77
Information sheet 7- Taking reference sample of honey, labeling and storing.....	78
Self-Check – 7	81
LAP Test	83
LO 5. ASSESS PEST AND DISEASE OF HONEYBEE	84
INSTRUCTION SHEET	84
Information sheet 1- Inspecting bee hive.....	86
Self-Check – 1	90
Self-Check – 2	97
Information sheet 3- Observing flight paths around hive entrance	98
Self-Check -3.....	100
Information sheet 4- Implementing biosecurity measures in the Apiary site	101
Self-Check -4.....	103
Information sheet 5- Recording and using results of inspection.....	104
Self-Check -5.....	105
Operation Sheet - Colony inspection to assess pests and diseases	106
LAP Test	107
LO6. ASSESS HONEY BEE FLORA	108
INSTRUCTION SHEET	108
Information sheet 1- Carry out identification of honey bee flora.....	109
Self-Check -1	111
Information sheet 2- Confirming Bee floral calendar	112
Self-Check -2.....	113
Information sheet 3- Assessing a basic nutritional need of honey bee.....	117
Self-Check -3.....	120
Information sheet 4- Identifying conditions affecting plants for honey bee visiting	121
Self-Check -4.....	122
REFERENCES	123
ACKNOWLEDGEMENT.....	125

**LG # 67**

LO 1: Establish and monitor queen rearing and re- queen honey bee

Instruction sheet

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

- Obtaining and confirming tools, equipment, PPE and other requirements.
- Selecting breeding stock.
- Selecting Day-old larvae
- Transferring ripe queen cells into the nucleus 10-11 days
- Assessing vigor of the current queen
- Monitoring queen replacement signs of colony.
- Monitoring replacement queens
- Raising Queen Bee from a nucleus colony and re queen the colony
- Monitoring hive

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 –**

- Obtain and confirm tools, equipment, PPE and other requirements.
- Select breeding stock.
- Select Day-old larvae
- Transfer ripe queen cells into the nucleus 10-11 days
- Assess vigor of the current queen
- Monitor queen replacement signs of colony.
- Monitor replacement queens
- Raise Queen Bee from a nucleus colony and re queen the colony
- Monitor hive

Learning Instructions:

1. Read the specific objectives of this Learning Guide.
2. Follow the instructions described below.



3. Read the information written in the “Information Sheets”. Try to understand what are being discussed. Ask your trainer for assistance if you have hard time understanding them.
4. Accomplish the “Self-checks” which are placed following all information sheets.
5. Ask from your trainer the key to correction (key answers) or you can request your trainer to correct your work. (You are to get the key answer only after you finished answering the Self-checks).
6. If you earned a satisfactory evaluation proceed to “Operation sheets
7. Perform “the Learning activity performance test” which is placed following “Operation sheets” ,
8. If your performance is satisfactory proceed to the next learning guide,
If your performance is unsatisfactory, see your trainer for further instructions or go back to “Operation sheets”.



Information sheet 1 Obtaining and confirming tools, equipment, PPE and other requirements

Materials, tools and equipment requirements for queen rearing work

Always check that the tools and equipment you need are available and in good working order. If any items look worn or damaged, or if any are missing, you need to deal with this before going any further

Most systems of queen rearing use standard beekeeping equipment but employ some specialized equipment during the process. Most of the specialized equipment is inexpensive or can be constructed by the beekeeper. Some of the most important tools, equipment required for queen rearing are:

1. Cell cups, bars and frames

Larvae are placed in artificial queen cell cups (grafted). The cups are placed on bars which, in turn, are placed in frames. Cell cups can be produced from beeswax alternatively, plastic cell cups can be purchased from beekeeping suppliers.

2. Grafting tools

An assortment of grafting tools can be used effectively: Many different versions of metal grafting needles are produced. Some have a magnifying glass fitted to the stem which can help if one's eyesight is insufficient. Usually both ends are designed for grafting; each offers a different configuration.

3. Queen rearing kits

There are several queen rearing kits available (Jenter system, Nicot Queen System, Mann Lake Queen Rearing Kit, Ezi-queen queen rearing system) in which the queen is caged on a plastic comb with removable cell bottoms. The kit systems can be used to transfer larvae without grafting. With a single Karl Jenter kit, about 50 queens can be produced over 50 days. This is suitable for smaller beekeepers producing for their own apiaries.

4. Protection of queen cells

In general, the best acceptance and care by nurse bees is achieved when young queens emerge directly into their colony. If possible, ripe queen cells should be transferred from the rearing colony to the mating colony 1-2 days before emergence

Page 8 of 124	Holeta PTC Author/Copyright	Animal production Level III	Version -3 Jun, 2021
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Fig. 2. Sealed queen cells, 1-2 days before emergence, ready to be transferred to mating colonies or an incubator. Photo: J Wilde

5. Box hive/Nuclei box
6. Queen catcher
7. Queen cage
8. wax
9. knife
10. Knife scalpel blade scissors
11. Grafting needle
12. Frame of nursery cages which is used to hold cell cups.
13. Feeder frame
14. Dipping sticks
15. Magnifying glass
16. Table lamp (cold light)
17. All working tools of beekeeper like hive tools, smokers, bee brush, sprayer, and complete sets of personal protective cloth



Self-Check -1	Written Test
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Directions: Answer all the questions listed below.

1. List at least six tools and equipment requirements for queen rearing work

Note: Satisfactory rating - 6 points

Unsatisfactory - below 6 points



Information sheet 2- Selecting Breeding stock

2.1. Queen quality- the quality of the queen depends on:

- Genetic, Environmental factors and good management.
- Periodical re queening with young queens less than one year old, results in more honey production than colonies headed by old queens.
- Moreover, the loss of a queen represents a serious threat to the survival of the honey bee colony and beekeepers frequently require new queens to start new colonies and replace dead or failing queens.

2.2. Selective Breeding for Better Queens

Any beekeeper can produce new queens, and most do it accidentally. But a queen breeder produces new queens with the goal of maintaining and improving high quality stocks. Many honey bee behaviors are influenced by heritable genetic traits. As the mother of the entire colony, the qualities of a particular queen are expressed in every one of her offspring. These traits can have profound effects on the behavior and health of the whole colony:

A. Temperament

The reaction of a colony when it is approached, opened or otherwise disturbed can be a genetic trait. Africanized bees are particularly known for their extremely defensive behavior. Gentle strains are especially important when keeping bees in urban settings.

B. Mite tolerance:

Parasitic mites are among the greatest problems for beekeepers. The effectiveness of current mite treatments is limited, and their use has had other detrimental effects on colony health. Breeding bees which are able to remove or resist parasites without the assistance of beekeepers is an important step for improving the health of the beekeeping industry.

C. Disease resistance

Page 11 of 124	Holeta PTC Author/Copyright	Animal production Level III	Version -3
			Jun, 2021



Bees that exhibit hygienic behaviors are able to detect and remove diseased brood at a very early stage of infection. This behavior greatly reduces the chance that an entire colony will become infected with a contagious pathogen.

D. Colony population growth:

Some colonies will adjust their brood rearing to seasonal conditions. They may increase in size prior to a nectar flow, ensuring more foragers to collect nectar. They may also reduce their population during times of summer dearth or approaching winter, which allows them to use stored food more efficiently. Other colonies maintain a large population and brood area despite conditions. Honey production: Some colonies of bees will be better producers of honey than others in the same apiary.

E. Honey production

This is dependent on outside conditions as well as colony population, brood production and overall colony health. Typically, strong, healthy colonies are better producers of honey, and therefore, good honey production often indicates good overall colony health. As the beekeeper works to improve other traits that support colony health, honey production should also increase. A bee breeder should take care to select only colonies with the most desirable characteristics from which to propagate new queens. There is no perfect bee for all situations or conditions. Rarely will any single colony possess all the most desirable characteristics, but over successive generations, a beekeeper should continue to select for preferred traits. When selecting the breeding stock, beekeepers must consider their own criteria regarding which characteristics are most desirable. Beekeepers can select one or more high-quality hives in their own apiary to use as breeder stock, or purchase breeder queens from other sources. Commercial breeder queens may be instrumentally inseminated from selected drone lines to produce offspring with consistent traits.

These queens may cost several hundred dollars each and are generally used only to propagate more queens, which are then open-mated with local drones. When selecting for healthy, disease and mite-resistant queen lines, beekeepers are encouraged to breed from survivor stock. These are colonies that have not been treated with chemical

Page 12 of 124	Holeta PTC Author/Copyright	Animal production Level III	Version -3
			Jun, 2021



pesticides, but naturally possess traits that allow them to overwinter successfully on their own and remain productive.

Self-Check -2	Written Test
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Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. What are the factors affecting queen quality (3pts)
2. Write the criteria's to select breeding stock of queen bee (5pts)

Note: Satisfactory rating - 8 points

Unsatisfactory - below 8 points

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

Page 13 of 124	Holeta PTC Author/Copyright	Animal production Level III	Version -3
			Jun, 2021

Information sheet 3- Selecting Day-old larvae

The schedule of tasks for rearing queen bees is based on the natural development cycle of honey bee queens. This process cannot be sped up, slowed down or altered for the convenience of the beekeeper. Become familiar with the timing of each step and prepare all equipment, hives and bees to be ready on the appropriate dates. If planning to rear a large number of queens on a continuous basis, plan ahead so that mature cells are removed from finisher hives before new grafts are removed from the starter. Prepare sufficient mating nucs before virgin queens emerge. Keep accurate records of each step in the process.

Day 1 breeder queen lays eggs

Day 3 eggs hatch

Day 4 graft larvae; place grafts into starter hive

Day 5 move grafts to finisher hive

Day 8-9 queen cells sealed

Day 12-14 move queen cells to mating nucs

Day 16 adult queens emerge from cells

Day 21 virgin queens begin nuptial flights

Day 30 mated queen laying eggs

Day 32 evaluate new queen's brood pattern



Fig. 2. Larval differentiation

The starter colony

- Choose a strong, 2-storey colony that is preferably headed by a 2 year old queen.
- Relocate the queen and the comb she is on (with bees), to a spare empty 8-frame box or nucleus hive.



- Move the 2-storey hive about 2 meters behind the original site.
- Prepare the starter colony by placing an empty box with bottom board and lid on the now vacant site.
- Transfer 4 combs of unsealed brood with adult bees from the 2-storey hive to the empty box.
- Place a comb of unsealed honey and pollen with bees on each side of the brood.
- Place empty combs in the box to fill the gaps.
- Add extra young bees into the starter colony by shaking bees from another 2 or 3 combs (preferably brood combs) of the 2-storey hive.
- Add a feeder of sugar syrup to the starter.
- The state of queenlessness will stimulate the nurse bees in the starter colony to feed and produce more brood food.
- Return the queen and the comb she is on to the bottom box of the 2-storey hive.

Page 15 of 124	Holeta PTC Author/Copyright	Animal production Level III	Version -3
			Jun, 2021



Self-Check -3	Written Test
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Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

Name..... ID..... Date.....

1. According to queen developmental stage, indicate the differentiation day of egg to larvae (3pts)
2. Mention how to prepare starter colony. (5pts)

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

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



Information sheet 4-Transferring ripe queen cells into the nucleus 10-11 days

The key in queen rearing is to take a young (12-24 hours old) larva from a worker cell and place (“graft”) it into a queen cell cup suspended vertically in a hive. The larva is fed on a special royal jelly diet by the nurse bees. After 10-11 days, the queen cells, which are ready to emerge, can be transferred to queen less hives or mating nuclei (“nucs”) (Woodward, 2007). The success and quality of queen production depends on strong, well fed and healthy nurse colonies and on suitable equipment and colony management.

Larval transfer

The term ‘larval transfer’ describes accurately this method of rearing queens, but the word ‘grafting’ is used colloquially and will therefore be employed here. Transferring small larvae from cell to cell requires excellent close-up vision and so, for many bee-keepers, reading glasses and/or a magnifying glass may be necessary. If all the following looks a little complicated at first, persevere: it really is simple, is invariably successful and well worth the effort.

Page 17 of 124	Holeta PTC Author/Copyright	Animal production Level III	Version -3
			Jun, 2021



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

Directions: Answer all the questions listed below.

- 1. The success and quality of queen production depends on:
 - A. Strong worker bees
 - B. well-fed and healthy nurse colonies
 - C. suitable equipment and colony management
 - D. All

Note: Satisfactory rating - 3 points Unsatisfactory - below 3 points

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



Information sheet 5- Assessing vigor of the current queen

Queen selection

Nature's method of disposing of an old, impotent or ineffective queen and the bees' swarming impulse can be used at any time to rear several queens for the hive. A beekeeper who needs one or many queen bees can stir the worker bees' impulse to rear queens by artificially creating the situations mentioned above. To do this some preparation is needed. The beekeeper should first choose a breeder queen of high quality, that is, one with the desired traits. A beekeeper who needs to work with friendly, docile colonies will obviously choose to breed from such a hive, while one who needs "killer bees" to defend his property will breed from aggressive colonies. In all cases, a selection of the desired breeding stock is very important because however competent the rearing technique, the resulting queens will be inferior if the stock is poor.

While assessing the vigor/strength of the queen through inspection:

Poor performing queens

Some queens, even young ones, don't have the ability to build up the colony strength. A poor, uneven brood pattern might indicate that this is happening. The brood pattern should be denser and of poor performance seems scattered or spotty up on observation. As a general rule, older queens/ damaged queens lay fewer eggs and are less active. This shows in uneven brood patterns. Older queens should be replaced as they don't have the ability to head a strong colony.

In general, if the queen is not vigor the observed can be:

- Aggressiveness of honey bees in the colony
- Drone eggs are dominant on the comb mass due to older queen
- Poor disease resistance colonies formed
- Poor performance by workers in production of honey and foraging
- Less tendency to swarming impulses and the like

Page 19 of 124	Holeta PTC Author/Copyright	Animal production Level III	Version -3
			Jun, 2021



Self-Check – 5	Written test
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Name..... ID..... Date.....

Directions: Answer all the questions listed below.

1. The brood pattern can be: A. observed by internal inspection B. can indicate the vigor ness of queen C. the age of queen D the direction of prevailing wind E. all

Note: Satisfactory rating - 3 points Unsatisfactory - below 3 points

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



Information sheet 6- Monitoring queen replacement signs of colony

There are different mechanism through which we monitor queen replacement by observing the signs of swarming. These are:

- Artificially swarming colony by removing part of colony to other areas by migration
- Make a new nucleus colony and returning it once swarming period is over
- Manipulating brood box to allow more room for egg laying and so reduce congestion
- Moving colony to a honey flow areas to divert their inclination from swarming impulses to honey production
- Providing beeswax foundation for bees to build worker comb if they are in need of extra comb for construction
- Removing capped brood and bees and introducing them into weaker hives. So after hatching or the young emerging the population of worker bees increase which enables to more surplus honey production
- Requeening colony with a young queen from a strain of bees known to be less likely to swarm

Page 21 of 124	Holeta PTC Author/Copyright	Animal production Level III	Version -3
			Jun, 2021



Self-Check – 6	Written test
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Name..... ID..... Date.....

Directions: Answer all the questions listed below.

1. Requeening colony with a young queen from a strain of bees known to be less likely to swarm. A. True B. False

2. Removing capped brood of honey bees and introducing them into weaker hives can make weaker colony stronger. A. True B. False

Note: Satisfactory rating - 3 points Unsatisfactory - below 3 points

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



Information sheet 7- Monitoring replacement queens

Pe-

riodic replacement of old queens and /or failing queens by young and high quality one is an important management practice in commercial beekeeping industry all over the world. Queen cages come in various shapes and sizes, either plastic, wood or woven wire. All have a hole so the queen and escorts can be placed into the cage. The cage has a compartment where queen candy is placed to feed the queen and escorts. This also allows the hive bees to slowly release the queen by nibbling through the candy from the outside once you have taken the cork out.

There are many different methods that can be used to re-queen colonies and using a queen cage is the most popular method. Queens are transported in cages so it is best to use these to introduce the new queen. Other methods include:

- **Roll the queen in honey.**

The new queen is covered in honey and dropped into the brood nest between brood combs. The bees will quickly lick the queen free of honey and often accept the new queen as head of the colony. It is best to get the honey from the comb in the hive that the queen is being introduced into. Of course, only use disease-free honey!

- **Smoke.**

Use plenty of smoke to confuse the bees, then place the queen at the hive entrance and smoke her into the colony through the entrance.

- **Paper bag.**

Catch about ten worker bees from the hive and place them into a paper bag. Place the new queen into the paper bag. The bees will try to get out of the paper bag by chewing it and in the process will release the new queen. This can be a very successful method.

- **Uniting.**

It is possible to join two colonies together if one is made queen less. Place newspaper between both colonies. The bees will chew through the paper so that both colonies are united. The queen is usually accepted. This is considered a safe method of introducing a new queen.

When they arrive, check the queen and escorts for signs of pests and diseases.

Page 23 of 124	Holeta PTC Author/Copyright	Animal production Level III	Version -3
			Jun, 2021



Make sure your queens were accompanied by a health certificate or vendor declaration if required, or if you requested one.

Self-Check – 7	Written test
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Name..... ID..... Date.....

Directions: Answer all the questions listed below.

1. Mention the different methods that can be used to re-queen honey bee colonies.
(3pts)

Note: Satisfactory rating - 3 points Unsatisfactory - below 3 points

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



Information sheet 8- Raising Queen Bee from a nucleus colony and re queen the colony

8.1. Introduction

The Queen in a honeybee colony is the fully competent sexual female present and under normal conditions is the mother of all other individuals in the colony. To satisfy the demand and to increase the declining number of honeybee population it is very important to rear queen honeybees by different techniques of queen rearing.

Queen rearing: - is a process of producing virgin queen in a colony of honeybee.

8.2. Importance of queen rearing

- To replace the existing queen or old queens (because the actual life span of queen is five years in average and 2 years in commercial production
- To improve the genetic qualities of the honey bees
- To have extra queens
- Cheaper and better than buying foreign or unknown queen
- To replace for sudden loss
- Replace poor queens and drone laying queens, (don't delay or poor queens will produce poor drones, continuing the problem)

8.3. Methods of queen rearing

8.3.1. Simple method of queen rearing

I. Splitting method - This involves the division or splitting of strong colony in to two or more divisions/ parts and moving either of the parts by chance to one km from original place

II. Overcrowding method – Forcing of honey bee colonies to develop queen cells for swarming this can be done by reducing supers and merely by not adding supers

8.3.2. Commercial method of queen rearing

Page 25 of 124	Holeta PTC Author/Copyright	Animal production Level III	Version -3 Jun, 2021
----------------	--------------------------------	--------------------------------	-------------------------



I. Grafting method - This method involves the transferring of young larvae from a brood comb in to artificial queen rearing cups unlike the simple method of queen rearing grafting method requires the use of certain special equipment like

- Dipping stick used to make wax cell cups
- Grafting needle used transfer larval
- Queen rearing cups made up of plastic or wooden used to hold larvae
- Frame of nursery cage used to hold cell cups

8.4. Re queening colonies

There is no perfectly reliable method to introduce new queens to a colony. The success of queen introduction depends on the attractiveness of the new queen and the previous queen status of the colony. Unmated queens are less attractive than mated queens, and egg laying queens are much more easily accepted than queens that have stopped egg laying due to longer transport or other reasons. The best time for re queening is during a good nectar flow. It is important to make the recipient colony queen less for at least 6-8 hours, sometimes for 1 day. Furthermore, it is essential to destroy queen cells being reared by the colony before releasing the queen (even by hand after several days if the workers are not biting the cage). One should use a push-in cage to introduce queens during a low to marginal nectar flow as this allows the queen to begin oviposition, thus increasing the likelihood of her acceptance.

The most popular method is to replace the previous queen directly with the new one in its shipping cage. The candy compartment on the cage is exposed to allow the bees to slowly release the queen after consuming the candy. The success can be improved if the queen to be replaced is caged for about 7 days before re queening. Under difficult conditions or for the introduction of highly valuable queens, it is recommended to introduce the queen into a nucleus colony (also known as an “artificial swarm”, “split” or “nuc”). Those small units usually accept any kind of queen. The queens can then be safely introduced into strong hives by placing the nucleus with the new queen on top of the strong hives separated by an insert with screens on both sides to avoid direct contact

Page 26 of 124	Holeta PTC Author/Copyright	Animal production Level III	Version -3
			Jun, 2021



of the bees. Heat from the larger parent colony will pass into the upper unit and support the development of the nucleus colony. As soon as the young queen has built a brood nest and is surrounded by her own young bees, it is ready to be combined with the parent colony. The old queen from the strong colony and the double screen are removed and the young queen in its nuc colony is put on top of the brood box of the strong colony, just separated by a sheet of newspaper containing several slits. In this way, a re-queening success of 95-100% can be expected



Self-Check – 8	Written test
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Name..... ID..... Date.....

Directions: Answer all the questions listed below.

- 1. Forcing of honey bee colonies to develop queen cells for swarming can be done: (2pts)
A. merely by not adding supers B. by reducing supers C. by supering D. A & B

- 2. Mention the Importance of queen rearing (5pts)

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

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



Information sheet 9- Monitoring hive

Monitoring hive for acceptance by egg laying queen

Monitoring hive to standard colony

Feed recipient colony for a day or two to put them in a good mood. Mated queens one month old are accepted better than recently mated queens, it allows pheromone to develop. Avoid introducing a new queen to a different strain of bee, often fails. A virgin over 24 hours begins to develop 'queenly' scent and looked after better. Ensure plenty of young bees to look after queen, or add frame of hatching brood to boost numbers.

Don't introduce when the colony is under stress, robbing or nutritionally stressed or they may reject her. Colony should be healthy with low varroa. Recipient colony should have queen removed just before. If some time before then checked and any emergency queen cells removed.

A good, vigorous queen will always search for empty cells in which to lay eggs, preferring clean new cells. The beekeeper may therefore insert an empty comb into the warmest mid-section of the brood chamber, where the temperature is about 35°C. On the fourth day, the comb can be removed, inspected and sent to the appropriate location. Empty combs can always be collected from the empty sides of the hive. Where no such combs are available, incomplete comb can be positioned in the midsection of the brood chamber; the bees will continue to build it quickly so that the queen can lay eggs into it.

Records and emergence of the queens

Keep a record of the day the cells were grafted and the day the queens are due to emerge. This may be done by a system of marks on hives, bars and frames, and recorded in a notebook. A queen emerges 16 days after the egg was laid, or 13 days after the egg hatches into a larva. If a larva 24 hours old is grafted, a young queen will emerge 12 days later. If cells are left too long in the cell-building colony and a young queen emerges — she will destroy all the other cells.

Page 29 of 124	Holeta PTC Author/Copyright	Animal production Level III	Version -3
			Jun, 2021



Ideally, cells are best left until the day before they are due to emerge before being taken from the cell building colony and distributed to nuclei.

However, this timing could be disastrous if one larva was older than the others and a virgin emerged before the cells were removed for distribution to nuclei. Cells may safely be given to nuclei on day 12 after the egg was first laid, or even earlier if handled very carefully.

Self-Check – 9	Written test
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Name..... ID..... Date.....

Directions: Answer all the questions listed below.

1. The temperature of the mid- section of the brood chamber is ____ and explain if the temp. of it is more than or less than this point.(5pts)
2. A queen emerges ____days after the egg was laid, or _____ days after the egg hatches into a larva.(2pts)

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

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



Operation sheet 1.	Colony splitting when no swarm's impulse is present
---------------------------	--

Objectives

- To prepare starter colony
- Realize the important of splitting
- Understand the necessary preparation (procedure) that should be followed during different types of swarm impulses

Procedures

1. prepare the necessary materials
2. Opening a hive and transferring some of the honeycombs to the new hive
3. Use genet smoke and inspect the brood nest.
4. Replace part of the colony with some brood combs containing sealed brood (3-4 combs) into the empty beehive. Make sure that you transfer with one of the brood combs, some eggs fresh larvae to the nucleus.
5. The honeycombs taken out initially should be placed on either side of the brood combs. The outer combs feed and help for the covering bees to keep the brood warm.
6. Shake additional bees into the nucleus. This is to have enough bees to warm and feed the brood.
7. Record your finding and report to your instructor /supervisor.

Page 31 of 124	Holeta PTC Author/Copyright	Animal production Level III	Version -3
			Jun, 2021



Operation sheet 2

Grafting of larvae

Objectives

To prepare young larvae for queen rearing

Step 1: prepare the necessary materials

Step 2 Larva floating on royal jelly

Step 3. The grafting tool in the vertical position close to the worker cell wall is slid under the floating larva

Step 4. The larva is lifted out

Step 5. The larva is placed into the queen cell by drawing the tool across the cell base

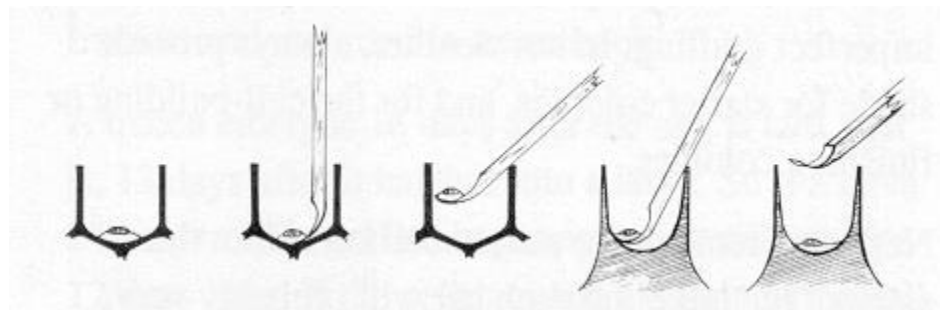
Step 6. Grafting is completed

Step 7. Record your finding and report to your instructor /supervisor

Precautions

As soon as grafting is completed, insert the bar of cells in the starter colony, avoiding dehydration of the larvae. The bar of cells is to remain there until the next morning. Do not overload the starter colony, 4 bars of cells are quite sufficient

The transfer of larvae to the prepared cell cups can then be performed.



The grafting process:



Operation sheet 3	queen raising
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Objectives

To raise young queen

Step 1: prepare the necessary materials

Step 2: establishing a starter colony for initial stage of raising queen cells

Step 3 establishing the cell building colony

Step 4 grafting honey bee larvae

Step 5 transferring the mature queen cells to honey bee nucleus colonies for the mating

Step 6 follow for egg laid by queen.

Step 7. Record your finding and report to your instructor /supervisor

Page 33 of 124	Holeta PTC Author/Copyright	Animal production Level III	Version -3
			Jun, 2021



LAP Test	Moisture content determination
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Name: _____ Date: _____

Time started: _____ Time finished: _____

Instructions: Use personnel protective equipment,
Given necessary templates tools and materials you are required to perform the following tasks within **9** hours.

- Task1: Perform Colony splitting**
- Task2: conduct grafting process**
- Task3: Perform queen rearing by splitting**



LG # 68

LO2. Manipulate honey bee brood

Instruction sheet

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

- Selecting and checking tools and equipment
- Observing any site quarantine
- Identifying risks and taking actions
- Conducting hive inspection
- Monitoring hive and colony

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 –**

- Select and check tools and equipment
- Observe any site quarantine
- Identify risks and taking actions
- Conduct hive inspection
- Monitor hive and colony

Learning Instructions:

1. Read the specific objectives of this Learning Guide.
2. Follow the instructions described below.
3. Read the information written in the “Information Sheets”. Try to understand what are being discussed. Ask your trainer for assistance if you have hard time understanding them.
4. Accomplish the “Self-checks” which are placed following all information sheets.
5. Ask from your trainer the key to correction (key answers) or you can request your trainer to correct your work. (You are to get the key answer only after you finished answering the Self-checks).
6. If you earned a satisfactory evaluation proceed to “Operation sheets



Information sheet 1- Selecting and checking tools and equipment

For this unit of competency, you should have select and check the following tools and equipment:

- Participants Learning Guide (this booklet)
- Participants Assessment Workbook
- Active hives and equipment
- Replacement queen bee(s)
- If purchased interstate, a health certificate for the queen bee(s)
- Tools and equipment:
- Personal protective equipment (bee veil, gloves, overalls, safety goggles, steel capped boots, sunhats and sunscreen lotion)
- Bee smoker, fire extinguishing equipment, hive tool,
- Spare boxes(super, frames with and without comb foundation sheet, inner cover, lids, bottom board)
- Smoker fuel, safety box for smoker, newspaper to first start the smoker and water to wash hands and put out smoker.

Page 36 of 124	Holeta PTC Author/Copyright	Animal production Level III	Version -3
			Jun, 2021



Self-Check – 1	Written test
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Name..... ID..... Date.....

Directions: Answer all the questions listed below.

1. Mention at least five important tools and equipment of brood management activity (5pts)
2. What are spare boxes? (2pts)

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

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



Information sheet 2- Observing any site quarantine

2.1. What is brood ‘

Brood’ is the eggs, larvae and pupae of the bee. All these stages of the bee’s development can be found within a colony at the same time. How long the brood is at each stage of development depends on the caste of the bee. Brood is tended by worker bees.

2.2. Why manipulating brood is important

Brood manipulation is practiced by successful commercial beekeepers to force the queen to increase the brood nest so that more worker bees are present in the colony. The more workers, the greater the potential honey yield or quantities of package bees to sell. Regular brood examinations are an essential part of competent management and if done properly it will lead to better production and profit by:

- Early detection of any particular disease problems thus reducing losses.
- Swarm control before the swarm escapes.
- Indicating the brood, honey and pollen stored in the brood nest
- the condition of the queen and the ability as an egg layer
- The temperament of the colony
- Indication of brood rearing condition if the brood nest is reducing or expanding
- Indication it may be possible to divide the hive
- to cull combs
- Encouraging increased hive population through providing more room for egg laying by removing full frames (of either brood or honey) and providing empty combs

If brood manipulation is practiced at the wrong time of the year, or the brood is over-spread, serious damage can be done to the colony. This learning guide will help you judge when and why to manipulate brood to achieve the best results.

Page 38 of 124	Holeta PTC Author/Copyright	Animal production Level III	Version -3
			Jun, 2021



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

Directions: Answer all the questions listed below.

- 1. what are the reason for brood manipulation (2pts)
- 2. What is brood? (2pts)
- 3. Describe the use of brood in human being diet. (2pts)

Note: Satisfactory rating - 6 points Unsatisfactory - below 6 points

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



Information sheet 3- Identifying risks and taking actions

This learning guide will help you judge when and why to manipulate brood to achieve the best results.

Be aware of possible risks to yourself and others:

- Bee stings- this can cause allergic reaction to human being and domestic animals in three forms.(localized, systematic and anaphylactic reactions)
- Dust - the wind-blown can contaminate the brood
- Airborne and soil micro-organisms
- Fire- is a serious problem in low land areas. It can destroy forest and colony of bees. It also dehydrate by evaporating the water content of brood
- Holes in uneven surfaces – brood combs are apt to break while transporting or moving from one place to another place.
- Noise
- Incorrect manual lifting
- Wildlife, including snakes and spiders
- Domestic stock –disturb the colonies.
- Solar radiation and wind direction

To overcome these risks, it is very important to carry out proper colony management and implement OHS properly.

Page 40 of 124	Holeta PTC Author/Copyright	Animal production Level III	Version -3
			Jun, 2021



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

Directions: Answer all the questions listed below.

1. What do you think are the most likely OHS hazards that might occur while you are manipulating brood? (3pts)
2. What can you do to prevent this? (3pts)

Note: Satisfactory rating - 6 points Unsatisfactory - below 6 points

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



Information sheet 4- Conducting hive inspection

Inspection for brood manipulation

Rules associated with brood manipulation or examining the brood nest

- Never transfer frames between colonies that show symptoms of any brood disease. If the disease is notifiable, contact your State Apiary section, and stop all work on the apiary.
- Careless handling can lead to the death of the colony queen.
- Avoid incorrect placement of combs or replacing too many combs.
- Spread of disease before any comb is placed into another colony the whole colony must not show any signs of brood disease of combs between colonies so if disease shows up you must be able to trace the combs movements.
- Manipulating combs during extremely cold or changeable weather can result in chilled brood. This occurs where the adult bees are not able to keep the brood at the required temperature of 35° C. The brood becomes chilled and dies.
- If combs of brood are left in direct sunlight on a hot day the brood can die of over-heating and combs that are starting to melt.
- Nosema, the adult bee disease, is a common condition in bee hives. When a hive is opened, this can be followed by a rise in the average nosema spore levels. Depending on the spore levels, many bees can die prematurely in the late winter and early spring, just when brood manipulation occurs. Try and only manipulate brood on warm sunny days and don't cause too much stress by over extending or splitting up the brood nest make sure bees cover all the brood combs.
- All combs with brood and the frames should be placed into the colony you want the queen to lay in.

Page 42 of 124	Holeta PTC Author/Copyright	Animal production Level III	Version -3
			Jun, 2021



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

Directions: Answer all the questions listed below.

1. What are the rules associated with brood manipulation or examining of the brood nest (3pts)

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

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



Information sheet 5- Monitoring hive and colony

Hive and colony of honey bee should be monitored, checked and examined after manipulation processes

The main uses of brood

- Food stuff for the human being.
- Supplementary feeding of powder made from bee brood to pigs, rabbits, birds (in particular singing birds)

Important Hive and colony manipulation

Considerations are:

- Disease problem during manipulation process
- Readiness of swarming
- Condition of the queen and queen ability to lay egg
- Brood pattern denser or scattered- can be due to several factors which includes age of queen, availability of feed sources, position of hive etc
- Age of comb- older and darker combs are rejected by the queen bees so culled or melted
- Hive temperature
- Enemy attack against ant, wax moth etc

If brood manipulation is practiced at the wrong time of the year, or the brood is over-spread, serious damage can be done to the colony that should be corrected and appropriate measures should be taken.

Page 44 of 124	Holeta PTC Author/Copyright	Animal production Level III	Version -3
			Jun, 2021



Self-Check – 5	Written test
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Name..... ID..... Date.....

Directions: Answer all the questions listed below.

- 1. Mention the most important points considered during hive and colony monitoring?(5pts)

- 2. what is the importance of brood(2pts)

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

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

**LG # 69****LO3. Handle honey bee swarm and swarming behavior****Instruction sheet**

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

- Obtaining and confirming all equipment
- Placing dry drawn frames in hive box
- Monitoring signs swarming
- Identifying risks in handling bees
- Considering and monitoring swarming

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 –**

- Obtain and confirm all equipment
- Place dry drawn frames in hive box
- Monitor signs swarming
- Identify risks in handling bees
- Consider and monitor swarming

Learning Instructions:

1. Read the specific objectives of this Learning Guide.
2. Follow the instructions described below.
3. Read the information written in the “Information Sheets”. Try to understand what are being discussed. Ask your trainer for assistance if you have hard time understanding them.
4. Accomplish the “Self-checks” which are placed following all information sheets.
5. Ask from your trainer the key to correction (key answers) or you can request your trainer to correct your work. (You are to get the key answer only after you finished answering the Self-checks).
6. If you earned a satisfactory evaluation proceed to “Operation sheets



Information sheet 1- Obtaining and confirming all equipment

Honey bees can reside in any empty space like hollow part of trees, crevices of rock in underground, under roof and base floor etc in place where we cannot imagine as nesting place, bees reside or make their shelter while looking for bees think of such sites as possible nesting site.

Honeybees would like to live in a most difficult site in order to protect themselves from the invasion of ants and other predators some sites are beyond the reach of human and most difficult to see the actual spot of their nest

What is swarming?

Swarming is honey-bee reproduction at colony level rather than bee-to-bee sexual reproduction. In this way, honey-bees are able to increase their numbers by increasing their colonies and also to invade new areas. Because this is a natural method of reproduction and dispersal, it is difficult to stop it from occurring. Most swarming occurs from around May to June in the Northern Hemisphere and from September to early December in the Southern Hemisphere.

All materials and equipment should be obtained and confirmed

- Swarm tapping just any box or any a locally available materials
- Queen cage
- Crude honey collection trays, in case if there are honey inside
- Smoker
- Axe or knife
- Water and water sprayer
- Bag or bowls to collect old combs
- Protective materials i.e. Vail, suit, & boots
- Rope (5 to10 meters long)

Page 47 of 124	Holeta PTC Author/Copyright	Animal production Level III	Version -3
			Jun, 2021



Self-Check – 1	Written test
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Name..... ID..... Date.....

Directions: Answer all the questions listed below.

- 1. Mention at least five important tools and equipment used in swarm manipulation (5pts)
- 2. What is swarming? (2pts)

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

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



Information sheet 2- Placing dry drawn frames in hive box

2.1. Drawn comb

Regardless of whether or not you use frames with foundation, bees will create their own beautiful comb. Comb created by bees is called "drawn comb" and it is ready for brood, pollen or honey. Drawn frames are frames having a wax foundation sheet to replace the naturally drawn comb of the bees.

This has a lot of advantages for the bees and the bee keepers. For the bees it saves their times wasted by secreting wax for the construction. They can catch honey flow period.

2.2. What hive foundation is best for you and your bees

As beekeepers we tend to stay with a proven foundation type and really do not look at where time and technology has brought to beekeeping. Have you ever had bees reject the foundation wax and they build a comb adjacent to the foundation? After starting more than 4,000 hives over the past several years, I wanted to share the pro's and con's of each foundation type.

Pro's – The natural bees wax foundation is an excellent foundation to get your bees started in combing out the new foundation. Mostly manufactured in large cell. With some homework you may be able to find small cell foundation.

Con's – (1) Natural wax can become brittle and break or crack while in transit to your home during cold weather. (2) During honey extraction you will need to extract at a slower RPM. If you use a high RPM during extraction, the foundation will experience a separation from the frame. This is not good news... (3) The foundation can warp within the frame during hot summer days during the first 48 hours of being placed in the hive.

2.3. Do Bee frames need foundation?

A frame without foundation allows the bees to naturally build what they need. Honeybees build different size cells for different purposes, so going foundationless allows the bees to build whatever size cells they need at the time.

Page 45 of 147	Field 10 Author/Copyright	Animal production Level III	Version 10 Jun, 2021
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Figure.3. wax foundation frames drawn by the bees Figure 4 pure wax foundation sheet

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

Directions: Answer all the questions listed below.

1. What is the problem if Brood frames space is wider than 37mm (11 frames/box) or the inter-comb space becomes too wide (3pts)

2. What is the advantage of placing the drawn frames in the hive? (3pts)

Note: Satisfactory rating - 6 points Unsatisfactory - below 6 points

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



Information sheet 3- Monitoring signs swarming

As your colony grows – and it can very rapidly in the spring – you have to make sure it has enough room. The queen needs room to lay eggs and the workers need room to store honey. If the growing population does not have enough space, the bees will swarm, and this is one of the most perplexing problems in beekeeping. It is especially difficult for commercial beekeepers with perhaps thousands of hives to look after but, even for the hobbyist with just a couple, it can be a discouraging task to limit or prevent this phenomenon.

If your bees swarm, there will be a long break in your colony's development because a new queen has to be mated and built up in the egg-laying stakes. There will be fewer bees in your hive to gather honey, and the colony will have to wait for some weeks for new bees to go through the egg to adult-forager-bee process. Your colony may thus not have the time to make a surplus of honey that year and, if it does, it will be very much reduced.

Preparing to swarm

As a result of certain conditions in the hive, the bees in your colony will raise new queens. The process begins when worker bees make small cell cups on the comb, mostly near to the comb's outer edges and especially along the bottom. These small cups don't necessarily indicate immediate swarming as they may never be used but, once the conditions arise that cause the swarming impulse to manifest itself, the queen will be directed towards these cups and will lay an egg in some or all of them. At this stage, the beekeeper must take note and commence swarm-prevention procedures. The colony will develop these cups into queen cells that are so distinctive they are very easy to recognize

Causes for swarming

- The presence of drones
- The presence of queen cells (see Figure 16).
- Over crowding of the nest, especially the brood area

Page 51 of 124	Holeta PTC Author/Copyright	Animal production Level III	Version -3 Jun, 2021
----------------	--------------------------------	--------------------------------	-------------------------



- Inherent swarming tendency of the strain
- Overheating of the colony



Figure 5.. A queen cell hanging from the bottom of a frame (note the 'sculpture' of the cell)

A virgin queen emerges

If left alone, after around 16 days, from one or more of these cells a virgin queen will emerge that will take over the colony, the old queen having departed with the swarm. This new virgin queen will go to the other queen cells, if allowed to by the workers, and will sting through the cell to kill off her potential rivals.



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

Directions: Answer all the questions listed below.

Mention signs of swarming and its control measures. (5pts)

1. Mention the causes of swarm(4pts)

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

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



Information sheet 4- Identifying risks in handling bees

A number of different factors are considered to be involved and are now being monitored and investigated further such as pests and diseases, bee management, including bee keeping practices and breeding, the environment, including weather, agricultural practices and the use of pesticides and the availability and quality. These risk factors has to be identified in order not to bring significant harms on the production and productivity.

There may just be one objection to this policy, however. If there are insufficient bees in the hive to move up into the new supers – especially the top ones – and you have used frames of comb, then the wax moth may enter and damage the comb, sometimes beyond repair.

The bee sting also has its impact on the animals and human being if the PPE is not properly used

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

Directions: Answer all the questions listed below.

1. Mention at least three risks identified while handling bees and mention their controlling measures. (6pts)

Note: Satisfactory rating - 6 points Unsatisfactory - below 6 points

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

Page 54 of 124	Holeta PTC Author/Copyright	Animal production Level III	Version -3 Jun, 2021
----------------	--------------------------------	--------------------------------	-------------------------



Information sheet 5- Considering and monitoring swarming

Swarm prevention or swarm control?

Remember, if your bees swarm, half your honey-collecting field force will go and there will be a long gap before the hive is up and running again because the bees will have to wait for the replacement queen to mate and lay eggs. You will then have to wait for these eggs to become bees. So you must do something about swarming, and swarming only happens significantly in the spring.

First, there is swarm prevention and, second, there is swarm control. Swarm prevention is all about managing your colonies so that the swarming impulse doesn't arise in the first place.

Swarm control is about letting the bees swarm, but only under your control so that you at least retain the bees. This may occur when you have left it too late to prevent them from swarming or, despite your best attempts at swarm prevention, the bees are still determined to swarm – and it happens.

Preventing swarming

Very experienced beekeepers advocate many methods for preventing swarming.

The two main culprits are clipping one of the queen's wings and, in conjunction with this, destroying queen cells. Those who advocate clipping the queen's wings, say this prevents her from flying and so going with a swarm. The theory is that she will rush out with the swarm, fall on to the grass and climb back into the hive. The swarm, in the meantime realizes the queen is not with them and flies back to the hive.

Methods to prevent swarming

Good swarm-prevention methods should reduce swarming with a low degree of colony interference and should be compatible with good colony management for both pleasure and profit. It goes without saying that a very good method is to obtain a strain of bees that has a lower tendency to swarm.

Page 55 of 124	Holeta PTC Author/Copyright	Animal production Level III	Version -3
			Jun, 2021



Re-queening annually (or at least every two years)

This is one of the best methods for limiting swarming in your colonies, especially if you are a commercial beekeeper and have perhaps thousands of hives.

Reversing hive bodies

In the early spring, reversing hive bodies can be a useful and effective method of swarm prevention. This simply involves swapping the positions of the upper and lower brood boxes (if you have them). Alternatively you can place a second brood box on top of the first. This box should have frames of empty comb, and a frame of capped brood from the existing brood box should be placed in the middle of it. Bees tend to work upwards, and so giving the colony more room for brood and for themselves reduces overcrowding and, in turn, reduces the inclination to swarm. Start this when you see a number of queen cups or before, if possible. Don't leave it to the stage when queen cells are started. This manipulation is very simple – whole boxes are moved, and this is effective especially if used in conjunction with other methods. After about two weeks, reverse them again if the bees have moved up and keep this up until the end of the swarming season.

Supering up

This involves putting honey supers on to the brood body(s) in time for the honey flow. The first box should be filled with comb, especially if the season is early – bees have difficulty producing wax early on in the year. Putting supers on in time is not only essential for honey storage preparation but it also limits swarming by giving the bees more room in the hive.

Keeping your colonies equal in strength

This can be done in two ways. You can move frames of brood from strong colonies in danger of overcrowding to weaker colonies, or you can swap the positions of weak and strong hives. This latter manipulation can also be quite effective on hives

Page 56 of 124	Holeta PTC Author/Copyright	Animal production Level III	Version -3
			Jun, 2021



that are near to swarming. In both cases you should ensure that both colonies are free from disease, otherwise you risk the chance of spreading it.

Ventilating your hives

Good hive ventilation goes a long way to lessen the swarming impulse if other methods are employed as well.

Controlling swarming

But what if you have missed all the signs and you look in your crowded hive one day during the swarming season and find queen cells? You've left it a little late but you can at least step in here to ensure the inevitable swarm will stay in your apiary in one of your hives and not fly off to some neighbor! Check to see if your colony has already swarmed (a good reason for having marked queens). If it hasn't or if it has and is still very populous, you can carry out the following manipulations.

The artificial swarm

This involves splitting a hive into two colonies. It is easily done

Page 57 of 124	Holeta PTC Author/Copyright	Animal production Level III	Version -3
			Jun, 2021



Self-Check – 5	Written test
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Name..... ID..... Date.....

Directions: Answer all the questions listed below.

1. Very experienced beekeepers advocate many methods for preventing swarming among these the most common are _____ and _____ (4pts)
2. What is the difference between swarm control and swarm prevention(4pts)
3. Mention at least three swarm prevention measures taken by experienced bee keepers (6pts)

Note: Satisfactory rating - 14points Unsatisfactory - below 14 points

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

**LG # 70****LO4. Remove honey crops from hive****Instruction sheet**

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

- Obtaining and confirming tools and equipment
- Determining and monitoring ripeness of honey
- The impact of time and location during the removal of honey
- Using range of suitable methods.
- Transporting honey-filled frames
- Checking moisture content of honey and storing
- Taking reference sample of honey, labeling and storing

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 –

- Obtain and confirm tools and equipment
- Determine and monitor ripeness of honey
- The impact of time and location during the removal of honey
- Use range of suitable methods.
- Transport honey-filled frames
- Check moisture content of honey and storing
- Take reference sample of honey, labeling and storing

Learning Instructions:

1. Read the specific objectives of this Learning Guide.
2. Follow the instructions described below.
3. Read the information written in the “Information Sheets”. Try to understand what are being discussed. Ask your trainer for assistance if you have hard time understanding them.
4. Accomplish the “Self-checks” which are placed following all information sheets.
5. Ask from your trainer the key to correction (key answers) or you can request your trainer to correct your work. (You are to get the key answer only after you finished answering the Self-checks).



Information sheet 1- Obtaining and confirming tools and equipment

6. If you earned a satisfactory evaluation proceed to “Operation sheets
7. Perform “the Learning activity performance test” which is placed following “Operation sheets” ,
8. If your performance is satisfactory proceed to the next learning guide,
9. If your performance is unsatisfactory, see your trainer for further instructions or go back to “Operation sheets”.



1.1. Introduction

Honey is defined as the sweet viscous fluid elaborated by bees from plant nectars which after transported to the hive by the honey stomach and stored in the combs for food

Honey is the sweet substance produced by honeybees from nectars of blossoms or from secretion of on living pests of plants, which they collect transform and combing with specific substance, and stored in honeycombs

1.2. Tools and equipment needed for honey Harvesting.

When the honey starts to flow, all variety of insects, including bees, will flock to the area. Because of this, the best place for you to do the honey harvesting is indoors. To start the process of harvesting the honey you will need your protective gear, frame super, a fully fueled smoker, and a hive tool. Hive tools are multi-purpose and are used for various duties, including scraping wax and moving the frames. A frame super is used to transport the frames full of honeycombs. Beginners will want to ensure their protective gear includes gloves that are sting-proof. The last thing you want is to drop frames and lose honey or injure bees because of a sting!

All tools and equipment required to remove a honey crop from a hive has to be ready and confirm their functionality. Some of these are:

- PPE, smoker and hive tool
- A colony with ripe honey /traditional hive
- Modern hive top bar or frame
- Bee brush – to remove the bees from the honeycombs
- Big dish –to collect the harvested honey
- Honey storage/ plastic tanks –to store the processed honey
- Uncapping fork or uncapping knife –to uncap the sealed honeycomb
- Honey extractor –to strain the harvested honey
- Honey tank with flow gate and Honey jar

Page 61 of 124	Holeta PTC Author/Copyright	Animal production Level III	Version -3
			Jun, 2021



Self-Check – 1	Written test
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Name..... ID..... Date.....

Directions: Answer all the questions listed below.

1. Mention at least four honey harvesting tools and equipment with their function(8pts)

Note: Satisfactory rating - 14points Unsatisfactory - below 14 points

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



Information sheet 2- Determining and monitoring ripeness/maturity of honey

2.1 Honey maturity

One of the most difficult things for new beekeepers is learning when to harvest their honey. If you're wondering what happens to honey if it is not harvested, you're probably also wondering whether your honey is actually ready!

Honey is usually harvested when the substantial flow of nectar draws to a close. This occurs at different times depending on your location. Colder climates will see this occur much earlier than warmer ones. In warm climates, the bees produce honey all year long. In both cases, however, you want to look into your hive and see that it is full of honey that is both cured and capped before you harvest.

Keep a close eye on your hive by checking every two weeks when the weather is warm. Note how many frames of capped honey you have each time you look. If you are using a shallow frame, honey is harvestable once it contains more than three-quarters ($\frac{3}{4}$) sealed and capped honey. Being patient just a little longer will reward you with a full frame if you are able to wait!

The honey crop is his reward for a year's hard work and imaginative planning.

The bigger the crop the more efficient has his management. Beginners always ask the question "when to harvest honey, the answer is when it is ripened when the honey is ripe the bees cap it with a thin layer of bees wax. Thus any capped or sealed honey may be removed from the hive

2.2. Moisture content

- Moisture content is one of the important criteria in the quality of honey because the rate of fermentation and its shelf life span is greatly determined by the amount of moisture content
- The moisture content of a honey can be measured using refractometer, based on the principles of refractive index of honey solution

Page 63 of 124	Holeta PTC Author/Copyright	Animal production Level III	Version -3 Jun, 2021
----------------	--------------------------------	--------------------------------	-------------------------



- In the world honey standard, the acceptable moisture content range is very strict it ranges 17.5% - 18.5%
- In some countries, honey with 20% moisture content can be accepted for industrial purpose other than table uses

2.2. Factors responsible for high moisture content are:

- Harvesting of unripe honey
- The Relative humidity of the surrounding
- Hygroscopic nature of honey
- Types of containers used



Figure 6.. Sealed/capped honey comb

Figure 7. sealed/ uncapped honey comb

- After the honey combs with frames are brought to the honey house.
- The sealed honeycombs should be uncapped in order to be extracted easily to let the easy flow of honey from the comb cells.
- The uncapped honey extracted by the manually or electric operated centrifugal honey extractor. There are many types of centrifugal honey extractor developed with various capacity of frame holding

Moisture content of honey can be determined with portable machine called Refractometer

Page 64 of 124	Holeta PTC Author/Copyright	Animal production Level III	Version -3
			Jun, 2021



Figure. 8: Refractometer

How to use a Refractometer

Open the slide cover and put a drop of honey sample and cover. Hold against light, view from the eye piece and adjust accordingly until you get a dark border line; where it marks is the percentage of the water content of that sample. Then, clean the slide thereafter



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

Directions: Answer all the questions listed below.

1. _____ is an instrument that is used to measure the moisture content of honey (2pts)
2. Which one of the following is not responsible for high moisture content of honey? (2pts)
 - A. Harvesting of unripe honey
 - B. The Relative humidity of the surrounding
 - C. Hygroscopic nature of honey
 - D. Storing honey for long period of time
 - E. Types of containers used
3. In some countries, honey with _____ moisture content can be accepted for industrial purpose other than table uses (2pts)
 - A. Above 20% M.C
 - B. 17.5% - 18.5%
 - C. 20%
 - D. all are possible

Note: Satisfactory rating – 6 points Unsatisfactory - below 6 points

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



Information sheet 3- The impact of time and location during the removal of honey

The harvest of honey should not be accomplished in rainy days or when the relative humidity is high, because this would lead to an increased moisture indexes in the honey. The beekeeper should decide for those hours which there is less air humidity on the sunny days. When harvesting, the beekeeper should not throw smoke directly on the honeycombs; this should be performed at small amounts, by using the bee smoker far away from the frames of honeycombs. These procedures are followed in order to reduce the incorporation of the smokeable smell into honey, as well as detritus from the bee smoker. After harvesting, the frames of honeycombs should not stay exposed to the sun for long periods because high temperatures can lead to the an increased hydroxymethylfurfural content (HMF) in the honey, reduced content of the main enzymes in honey (invertase, glucose oxidase and diastase), therefore endangering the honey quality. Many methods are available to separate bees from their honey combs. Honeycombs can be taken out one at a time and bees may be removed by shaking and brushing. Whole supers can be cleared of bees with a strong air blower (bee blower). An inner cover or special board with a one-way bee escape can be placed below the honey super.

None of these three methods will contaminate the harvested honey. The use of unpleasant smelling chemicals to drive bees away is a technique preferred by many beekeepers because it is quick and easy. Some of the chemicals are illegal for use in many countries, leave unpleasant flavours and odours, are toxic and are absorbed by wax and honey. Many methods are available to separate bees from their honey combs. Honeycombs can be taken out one at a time and bees may be removed by shaking and brushing. Whole supers can be cleared of bees with a strong air blower (bee blower). An inner cover or special board with a one-way bee escape can be placed below the honey super. Up to one deep, or two shallow supers, can thus be cleared in 24 hours, if enough space is available below. This method cannot be recommended if colonies are sitting unprotected in the sun, which might melt the combs in the now unventilated supers. None of these three methods will contaminate the harvested honey. The use of unpleasant smelling chemicals to drive bees away is a technique preferred by many beekeepers because it is

Page 67 of 124	Holeta PTC Author/Copyright	Animal production Level III	Version -3
			Jun, 2021



quick and easy. Some of the chemicals are illegal for use in many countries, leave unpleasant flavours and odours, are toxic and are absorbed by wax and honey. In order to avoid contamination the honeycombs should not be directly placed on the ground. The beekeeper should place them directly in a special transporting barrow, from which the base is preferentially a stainless steel tray or other material appropriate for food. They should be covered on such a way to avoid pillage, mainly at the end of the nectar flow season. B.-Transporting from apiary to the extracting room. The vehicle used in transporting the supers containing honeycombs to the extracting room should be prepared in the previous day, as subjected to a hygienic process. It is necessary that the vehicle did not recently transport any material that might have left some type of toxic residue, or otherwise has strong odor. Besides, the surface of the vehicle load area should be covered with nontoxic material, properly cleaned and free from impurities, in order to avoid the direct contact of the supers containing honeycombs with the floor. In case the vehicle has an open load compartment, the use of canvases that can cover the supers containing honeycombs is recommended; so avoiding the honey be contaminated by dust, earth and other contamination or by the residues from the combustion of the vehicle engine (mainly in cases of the diesel oil-moved motors). In addition, this procedure avoids the bees to plundering the honey. So, an appropriately dimensioned canvas can cover the floor of the vehicle and cover the upper surface of the supers, therefore efficiently involving the whole load. During the arrangement of the supers in the vehicle, it is recommended that this vehicle does not stay under the direct light of the sun, which may negatively affect the quality of the honey. For accommodation of the load, a hive cover placed on the lower canvas may be used. So performing as base for the piling of the supers, as well as a cover upon them that will impede the access of the bees during the formation of this supers pile. During their placement in the vehicle, the supers should be always covered by canvas until the total fulfillment of the load. So, the transportation process becomes more rapid and efficient, thus providing a safe and protected load. For a safe transportation, the supers should be well tied. Therefore avoiding their displacement in the case of

Page 68 of 124	Holeta PTC Author/Copyright	Animal production Level III	Version -3
			Jun, 2021



abrupt braking, that could lead to the break of the honey combs; mainly if they are constituted of new wax. In those non-asphalted highways presenting irregularities, the vehicle should be slowly driven and with the maximum care.

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

Directions: Answer all the questions listed below.

1. What is the available time and condition to remove honey from the hive? (4pts)

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

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



Information sheet 4- Using range of suitable methods for removing bees and honey

4.1. Introduction

When it's time to harvest honey, you will want to get bees out of the honey supers so it's easier to remove capped frames. Here are several methods/devices you can use for the task:

- Shake or brush bees from the frames
- Blow the bees off
- Add a fume board, or
- Use a bee escape (either by using a device that attaches to your inner cover or using a specially designed board).

4.2. Shake or brush bees from the frames

Shaking or brushing bees is a simple way to remove bees from any frame.

Lift the capped honey frame from the hive, hold it firmly and give it a good shake in front of, or over, the hive. You can also use a bee brush with a gentle, upward stroke to knock the bees off. (We often use a large turkey feather instead of a bee brush when we want to move bees around).

This is the most cost-effective method for removing bees from the frame as it requires no additional equipment (assuming you have a brush or feather as a primary tool anyway).

Since you lift individual frames to remove bees, you only shake bees from entirely capped honey. Other methods involve getting the bees out of the entire super before you take out frames. Removing bees of one frame at a time can be time-consuming.

Pay attention to the bees. If they become defensive from the shaking and brushing, your job can get more difficult. Usually, your smoker comes in handy in such a case. However, you need to use it sparingly, if at all, unless you like smoke-flavored honey. To blow bees out of honey supers, you can use a specially designed bee blower (which can

Page 70 of 124	Holeta PTC Author/Copyright	Animal production Level III	Version -3 Jun, 2021
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be very expensive especially if designed for “commercial” use) or a leaf blower (which may benefit from an attachment that directs the air more effectively).

4.3. Blow Bees Out Of Honey Supers

- To blow out the bees, set the super on its short side (frames are perpendicular to the ground) near the front of the hive. This arrangement will keep frames aligned and blow the bees out close to home. Using a stand to keep the box off the ground makes the task easier.
- Aim the blower from the top bars to avoid blowing the frames out of the box. If needed, move frames slightly to create more space to blow air in between them as you go.
- Blowing the bees out of the super should be relatively short work. I can see the value of this method if you have a lot of hives to work. But moving a lot of heavy supers is probably a two-person job.

N.B. If you opt for blowing the bees out of the super, make sure the queen is not in the box by using a queen excluder.

Visit -<https://www.beekeepingfornewbies.com/remove-bees-honey-harvest/>

4.4. Fume Board.

The fume board is a wooden frame with a cloth cover (typically felt) that serves as a temporary cover when you want to remove bees from the supers. Treat the cloth with a bee repellent that drives the bees out of the super into lower boxes.

Some bee repellents vaporize better on hot days. A black cloth can add to the solar power of the vaporization process.

4.5. Bee Escapes and Bee Escape board

Bee escapes and bee escape boards (also called “clearing boards”) are placed below the honey supers you plan to harvest.

Bees move down from the super, through the escape, attracted to the queen’s pheromones or to join the rest of the colony as temperatures drop at night. The escape’s design keeps the bees from easily navigating back through it to the super.

Page 71 of 124	Holeta PTC Author/Copyright	Animal production Level III	Version -3
			Jun, 2021



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

Directions: Answer all the questions listed below.

1. Mention the methods available to separate bees from their honey combs during honey harvesting (5pts)

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

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



Information sheet 5- Transporting honey-filled frames

1.1. Introduction

Producers, processors, retailers, whole sellers and exporters of honey to be aware of honey transportation specifications and regulations of national and international requirement. Honey shall be carried so as to protect containers from mechanical damage and contamination. Transportation of honey shall be done during the night in order to avoid the heat of the sun that could adversely affect the quality of honey or if done during the day shall be done using refrigerated or insulated containers.

After shaking the bees from individual frames for harvesting, it is important to take the honey filled frames to the processing area without the deterioration of hone quality

The goal of removing bees is to have bee-free frames for extraction and to avoid getting a lot of bees in your honey house or home. When you start the removal process, have a box ready for the honey frames where you can stop the bees from jumping on board again. Cover the box with a lid or damp cloth to keep bees out.

5.2. Transporting from apiary to the extracting room

The vehicle used in transporting the supers containing honeycombs to the extracting room should be prepared in the previous day, as subjected to a hygienic process. It is necessary that the vehicle did not recently transport any material that might have left some type of toxic residue, or otherwise has strong odor. Besides, the surface of the vehicle load area should be covered with nontoxic material, properly cleaned and free from impurities, in order to avoid the direct contact of the supers containing honeycombs with the floor. In case the vehicle has an open load compartment, the use of canvases that can cover the supers containing honeycombs is recommended; so avoiding the honey be contaminated by dust, earth and other contamination or by the residues from

Page 73 of 124	Holeta PTC Author/Copyright	Animal production Level III	Version -3
			Jun, 2021



the combustion of the vehicle engine (mainly in cases of the diesel oil-moved motors). In addition, this procedure avoids the bees to preying the honey. So, an appropriately dimensioned canvas can cover the floor of the vehicle and cover the upper surface of the supers, therefore efficiently involving the whole load. During the arrangement of the supers in the vehicle, it is recommended that this vehicle does not stay under the direct light of the sun, which may negatively affect the quality of the honey. For accommodation of the load, a hive cover placed on the lower canvas may be used. So performing as base for the piling of the supers, as well as a cover upon them that will impede the access of the bees during the formation of this supers pile. During their placement in the vehicle, the supers should be always covered by canvas until the total fulfillment of the load. So, the transportation process becomes more rapid and efficient, thus providing a safe and protected load. For a safe transportation, the supers should be well tied. Therefore avoiding their displacement in the case of abrupt braking, that could lead to the break of the honey combs; mainly if they are constituted of new wax. In those non-asphalted highways presenting irregularities, the vehicle should be slowly driven and with the maximum care.

Self-Check – 5	Written test
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Name..... ID..... Date.....

Directions: Answer all the questions listed below.

1. Mention the common cares given to honey filled frames during transportation and reason out why it is important (6pts)

Note: Satisfactory rating – 6points Unsatisfactory - below 6points

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



Information sheet 6- Checking moisture content of honey and storing

6.1. Checking moisture content

- The moisture content of a honey can be measured using refractometer, based on the principles of refractive index of honey solution
- Moisture content is one of the important criteria in quality determination of honey because the rate of fermentation and its shelf life/ span is greatly determined by the amount of moisture it contain.
- In the world honey standard, the acceptable moisture content range is very strict it ranges **17.5% - 18.5%**
- Some countries, honey with **20%** moisture content can be accepted for industrial purpose other than table uses

6.2. Storing the honey

The honey should be stored in a glass jars or plastic containers with well sensed lids or in metal containers which have been coated on the inside with a layer of liquid Para fine or plastic. In humid areas the honey must be stored in air tight containers with in a few days after extraction the honey can start fermentation during storage if the moisture content is too high (more than 18%)

Honey for retail sale shall be packed in hygienically clean, plain, well sealed jars or any other suitable containers which are food graded, acid resistant, non reactive (stainless steel, plastic or glass) to the content and cannot cause the transfer of foreign odours to the honey.

- The container must be moisture – proof.
- Mouth of the containers must be wide enough to facilitate removal of crystallized honey.
- Containers which previously contained other commodities (e.g. kerosene, gasoline, oils, alcohol etc.) should not be used in packing honey.

Page 75 of 124	Holeta PTC Author/Copyright	Animal production Level III	Version -3
			Jun, 2021



- Honey for bulk sale shall be packed in new or used lacquered drum.

In general, the honey has to be kept in air tightened containers

- In dry places
- In cool places
- The honey has to be with fewer amounts of yeast spores
- Low moisture content

Page 76 of 124	Holeta PTC Author/Copyright	Animal production Level III	Version -3
			Jun, 2021



Self-Check – 6	Written test
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Name..... ID..... Date.....

Directions: Answer all the questions listed below.

1. Mention the common storage materials of honey and explain why these materials are selected (6pts)

Note: Satisfactory rating – 6points Unsatisfactory - below 6points

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



Information sheet 7- Taking reference sample of honey, labeling and storing

7.1. Introduction

The quality of honey is determined primarily while it is being produced in the hive. The beekeeper plays an important role in this, as well as the size of the hive and the timing of the harvest. The quality of the products can scarcely be improved once they have been removed from the hive, but their quality can be diminished during harvesting, extraction, further processing and storage. Preserve duration can be improved during further processing but this also diminishes the quality in certain ways: the product loses its freshness and its therapeutic value is reduced. The edible products (honey, pollen, bee bread, bee milk and bee brood) all contain biologically active ingredients that can lose some of their effectiveness. Beeswax, propolis and bee venom, on the other hand, retain their original qualities much better after extraction and further processing

7.2. Quality control by the beekeepers

Beekeepers do not really need to perform complicated tests to determine the quality of their honey, because they know whether the honey is fresh and raw and whether the moisture content is good. They can see this by looking at how syrupy it is, for example. The beekeeper has also been present during production, harvesting, extraction and any other further processing and thus knows the products' production history. Simple measurement techniques are also available for use in the field. These are recommended, especially for larger producers and beekeepers' associations, because by measuring the result the beekeeper can improve the quality of his or her production methods. This will also allow him or her to market the products better.

7.3. Packaging, Marking, and labeling of honey

Accurate and consistent labeling of honey and honey products helps to ensure that honey and honey products are not **adulterated or misbranded** and enhances consumers' ability to make informed choices among products.

Page 78 of 124	Holeta PTC Author/Copyright	Animal production Level III	Version -3
			Jun, 2021



Misbranding

The common or usual name must accurately identify or describe, in as simple and direct terms as possible, the basic nature of the food or its characterizing properties or ingredients, and may not be “confusingly similar to the name of any other food that is not reasonably encompassed within the same name, ingredients required to be declared on the label or labeling of a food must be listed on its label by common or usual name in descending order of predominance by weight

Adulteration

Under section 402(b) of the FD&C Act, a food is adulterated if:

- A valuable constituent has been omitted in whole or in part from a food;
- Any substance has been substituted wholly or in part;
- Damage or inferiority has been concealed in any manner; or
- A substance has been added to a food so as to increase its bulk or weight, reduce its quality or strength, or make it appear to be better or of greater value than it is.

Labeling and marking provides useful information on producers, ingredient/content, quality grade, place of origin, and weight of the product, best before date etc.

- Honey for retail sale shall be packed in hygienically clean, plain, well sealed jars or any other suitable containers which are food graded, acid resistant, non reactive (stainless steel, plastic or glass) to the content and cannot cause the transfer of foreign odours to the honey.
- The container must be moisture – proof.
- Mouth of the containers must be wide enough to facilitate removal of crystallized honey.
- Containers which previously contained other commodities (e.g. kerosene, gasoline, oils, alcohol etc.) should not be used in packing honey.
- Honey for bulk sale shall be packed in new or used lacquered drum.

Honey packed for retail sale

Page 79 of 124	Holeta PTC Author/Copyright	Animal production Level III	Version -3
			Jun, 2021



Following these principles will help maintain your honey in the best possible condition:

- reject any damaged honey containers
- clean all honey containers with hot water or steam
- drain all honey containers and allow them to dry before use
- only use food grade honey containers except 200 litter galvanized drums that can be used for short term storage until they are phased out of use
- ensure all bulk honey containers have food grade seals and are completely full
- store honey out of direct sunlight, preferably in a covered storage area where the temperature never reaches 45°C
- Label the storage containers with the type of honey, floral source, date extracted and tracing identification data.

Page 80 of 124	Holeta PTC Author/Copyright	Animal production Level III	Version -3
			Jun, 2021



Self-Check – 7	Written test
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Name..... ID..... Date.....

Directions: Answer all the questions listed below.

- 1. What is the importance of labeling honey during storage (4pts)
- 2. Accurate and consistent labeling of honey and honey products enables consumer for _____(2pts)
- 3. What is adulteration? (2pts)

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

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



Operation Sheet 1- Harvesting honey from framed hive

Objective:

To get quality and high quantity Honey during honey flow period

Procedures for harvesting/cropping honey from frame hive

1. Put on your PPE properly and prepare the necessary materials
2. Open the hive is opened in the appropriate manner after the inner cover is removed
3. Assess honey super by visual examination of the frames to see that it is at least three quarters sealed and thus ready for removal or to see honey maturity
4. Smoke is blown down between the frames when most of the bees are out of the super the honey with frames will be taken off in such manner the honey frames will be harvested and brought to honey house.
5. The sealed honeycombs should be uncapped in order to be extracted easily to let the easy flow of honey from the comb cells.
6. The uncapped honey extracted by the manually or electrocuted operated centrifugal honey extractor. There are many types of centrifugal honey extractor developed with various capacity of frame holding
7. Keep your record

Page 82 of 124	Holeta PTC Author/Copyright	Animal production Level III	Version -3
			Jun, 2021



LAP Test	Harvesting honey from framed hive
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Name: _____ Date: _____

Time started: _____ Time finished: _____

Instructions: Use personnel protective equipment,
Given necessary templates tools and materials you are required to perform the following
tasks within **3** hours.

Task: Perform Honey harvesting from framed hive



LG # 71	LO 5. Assess pest and disease of honeybee
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Instruction sheet

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

- Inspecting bee hive
- Observing adult bees and brood combs
- Observing flight paths around hive entrance
 - ✓ The signs of poor or irregular flight patterns
 - ✓ The dead or dying bees
- Implementing biosecurity measures in the Apiary site
- Recording and using results of inspection Recording and using results of inspection

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 –**

- Inspect bee hive
- Observe adult bees and brood combs
- Observe flight paths around hive entrance
 - ✓ The signs of poor or irregular flight patterns
 - ✓ The dead or dying bees
- Implement biosecurity measures in the Apiary site.
- Record and use results of inspection Recording and using results of inspection

Learning Instructions:

1. Read the specific objectives of this Learning Guide.
2. Follow the instructions described below.
3. Read the information written in the “Information Sheets”. Try to understand what are being discussed. Ask your trainer for assistance if you have hard time understanding them.
4. Accomplish the “Self-checks” which are placed following all information sheets.
5. Ask from your trainer the key to correction (key answers) or you can request your trainer to correct your work. (You are to get the key answer only after you finished answering the Self-checks).
6. If you earned a satisfactory evaluation proceed to “Operation sheets

Page 84 of 124	Holeta PTC Author/Copyright	Animal production Level III	Version -3
			Jun, 2021



7. Perform “the Learning activity performance test” which is placed following “Operation sheets” ,
8. If your performance is satisfactory proceed to the next learning guide,
9. If your performance is unsatisfactory, see your trainer for further instructions or go back to “Operation sheets” .



Information sheet 1- Inspecting bee hive

1.1. Introduction

When handling or working with honeybees, you must check for any signs of pests or disease. By law, if you do notice something unusual or something that might indicate the presence of a pest or disease, you must report this and take the actions directed by your supervisor and/or apiary inspector. For example, if you notice signs of American foulbrood, the infected hive materials must be burned or sterilized

1.2. Inspecting bee hive for signs of diseases and pests

Hive/colony/ inspection- is one of the colony management, which enables to monitor honeybee's activity and ensure that the maximum strength of the colony coincides with the maximum nectar flow and others in order to obtain a maximum honey production. There are two ways /methods/ of colony inspection. These are:

1.2.1. External colony inspection

During External inspection the beekeeper should observe the following important points in case of diseases and pests.

If the bees are accumulated on the entrance of the hive it may be due to swarm preparation, enemy attack, honey ripening that can increase the internal hive temperature Also if dead bees /extra ordinary number of dead bees can be found on the entrance of the hive due to starvation and chemical poisoning

1.2.2. Internal colony inspection

To undertake internal colony inspection first of all the beekeepers should have to be able to minimize the stinging bees by:

- adjusting /arranging the working hours early in the morning or late in the evening
- carefully wearing of protective clothes

Page 86 of 124	Holeta PTC Author/Copyright	Animal production Level III	Version -3
			Jun, 2021



- keeping working clothes clean or free of bee venom
- using good quality smoke
- slow gentle movement while hive operation
- taking care not to crush the bees while removing the frame
- do not use any perfumes soaps that aggravate stinging

When handling or working with honeybees, you must check for any signs of pests or disease. By law, if you do notice something unusual or something that might indicate the presence of a pest or disease during hive inspection, you must report this and take the actions directed by your supervisor and/or apiary inspector. For example, if you notice signs of American foulbrood, the infected hive materials must be burned or sterilized.

1.3. Pests – are enemies/organisms that attack or hamper life activities and products of honey bees

A. Wax moth

- The infectious stage is larval stage not adult stage
- A mated female wax moth enter in the hive and lay about 400-1000 eggs in the racks and on the dudes of hives in her life time (3-30 days)
- The eggs hatch to larvae between 3-5 days (if incubated at 320c) and start to make inside combs & eat comb wax

The symptom of infected comb

Detected by the growing of larval spine silk lined webs through the wall and face of combs & damaged combs

Prevention and control methods

- strengthening the colony
- Attending proper seasonal management
 - ✓ Reduction of supers at dearth period & keep the combs in a well-ventilated room
 - ✓ Removing extracting it (cold tart at low tem <170c)
 - ✓ Clean & expose the hive to the sun or subject to air (up to 60^{0c} temp)
- Empty boxes should be fumigated with para dichloride benzene (PDB) before hiving the bees in it (chemical treatment)

Page 87 of 124	Holeta PTC Author/Copyright	Animal production Level III	Version -3 Jun, 2021
----------------	--------------------------------	--------------------------------	-------------------------



- Biological – introducing predators which eat the larvae of wax moth

B. Bee lice

External parasite attached on the thorax of honey bees especially (most of the time) on the queen

Control & prevention method

Putt small; amount of tobacco smoke to the hive

5.3. Predators

Are organisms enemies that prey or feed on adult bees?

A. Ants – are a serious problem in humid areas of the country. They can cause damage to hive product & honey bees Fe by annoying aggressive & even absconding and stealing hive products

Prevention and control methods

There are different ant control methods these are using:

- Chemicals like chloyodane but it also kill the bees
- Proper management like clearing the apiary site
- Destroying their nests
- Using differently made hive stand barriers

B. Termites - can affect the hive and hive stand. In the presence of termites around and in the hive the honeybees become extremely rest less. Kills and eat the bees so dead and halt eater bees around the hive is an indication of termite attack

Prevention and control methods

- Provide a good barrier between the hive ground
- Apply a lager of greases on the hive stand
- Treat the woods with creosote
- Make hive & stand from termite resistant woods

C, Brides - Directly feed on bees on flight, at apiary, watering area and during mating. The birds can also serve as guidance for honey badgers and honey hunters

D. Mammals Rats and bats etc - They have indirect effect on the honey bees and their products as they use as shelter for reproduction

Control and prevention methods

Page 88 of 124	Holeta PTC Author/Copyright	Animal production Level III	Version -3 Jun, 2021
----------------	--------------------------------	--------------------------------	-------------------------



Attending seasonal management like super reduction and cleaning the hive and site

E. Spider- using their webs & the vibration of webs catch the bees and eats the adult bees

Control measures

- Destroying their nest
- Cleaning the hive and clearing the surrounding
- Reducing super

F. Wasps -Eat the bees and their eggs (brood) extensively foraging bees and normally wasps attack honey bees first

Control & prevention method

- Kill manually
- Destroy their nest with in 3km of bee hive and carefully burn them
- Use pesticides

G. Honey Budes (shelemetmat, hamaa hamakosi hamagote)-This remove the bees using its bushy tail and prey on hive products that are honey and brood.

Control measures

Using fence around apiary dogs in apiary planting trees with thin leaves arrives around apian & using sharp metals & Guard

H. Prey mantids – eat bees

I. Shakes Frogs mice and

A. Death need hawk moth (DHHM) are enemies of Honey bees

Page 89 of 124	Holeta PTC Author/Copyright	Animal production Level III	Version -3
			Jun, 2021



Self-Check – 1	Written test
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Name..... ID..... Date.....

Directions: Answer all the questions listed below.

1. _____ are enemies/organisms that attack or hamper life activities and products of honey bees (2pts).
2. What are the symptoms of infected comb by wax moth (2pts)
3. Mention the prevention and control methods of ant form attacking the beekeeping activity? (4pts)

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

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

Page 90 of 124	Holeta PTC Author/Copyright	Animal production Level III	Version -3
			Jun, 2021



Information sheet 2- Observing adult bees and brood combs

2.1. Colony inspection

As mentioned in the above information sheet one, it is important to observe the adult bees and brood combs for signs of diseases through both external and internal inspection

2.2. Honey bee brood and adult bee diseases

Disease means absence or opposite of ease bees. Like all living creatures are subjected to diseases. Some of these diseases affects adult bees called Adult bee disease and others affect immature stages of honey bees called Brood disease

2.3. Causes of honey bee diseases

•	Causes	Brood and adult bee diseases
1	Bacteria	American foul Brood (AFB), European Foul Brood (EFB)
2	Protozoa	Nosema and Amoeba
3	Fungi	chalk and stone disease
4	Virus	Sac brood paralysis .etc
5	Parasitic mites	varroa (internal), Acarapis wood (External)

These honey bee diseases are transmitted or spread from colony to colony by different means of swarming, infected equipments, Drifting, Robbing, interchanging the brood combs between diseased and health colonies



1.1.1. Brood diseases

- Entirely affects the whole colony
- Difficult to treat because some of the combs are sealed and others are not sealed

A. American foul Brood prevention and treatment method

American Foul Brood (AFB)

AFB is probably the most serious of the brood diseases. It is highly infectious bacterial disease and can be spread by drifting bees, by robbing and by the beekeeper moving from an infected hive to others during inspections. Colonies that have AFB must be destroyed. By this I mean that the bees must be killed and brood frames burnt. Woodwork other than the frames may be saved, depending on state or national laws, but must usually be thoroughly sterilized

- Caused by bacteria called *Bacillus larvae*
- Kills the larvae of the three castes at prenatal stage
- It causes large losses in bees and honey equipments because the spore remains infective for at least 35 years

Prevention and control and treatment

- No chemotropic for efficient prevention

B. European Foul Brood / EFB

Like AFB, EFB is a bacterial disease. The causal agent of EFB is the bacterium, *Melissococcus pluton*, which infests the guts of bee larvae. Although considered less damaging to a colony than AFB, it should never be underestimated and should be attended to if and when detected. The bacterium does not form spores, although it can overwinter on comb. Because it doesn't form spores it's not as infectious as AFB and, if it is caught in its early stages, the colony can usually be saved. EFB is often considered a 'stress' disease – a disease that is dangerous only if the colony is already under stress for other reasons such as frequent moves, other disease problems, pesticide poisoning and so on. If the colony is given the chance to build up, however, it can usually survive. Affects the larvae of all castes equally up to 48 hours & the larvae die within one or two days

Page 92 of 124	Holeta PTC Author/Copyright	Animal production Level III	Version -3
			Jun, 2021



- The larvae die of starvation because of the action of the bacteria in the gut, and they change to an off-white colour – not the pearly white of healthy larvae.
- The larvae adopt unnatural positions in the cells and are not coiled neatly
- The larvae appear to ‘melt down’ and to lose definition.
- The bees do not usually cap infected cells, but larvae that are capped may die of the disease and, in this case, the cappings are sunken and often perforated (pepper pot).
- The later stages of the disease produce a foul smell – often worse than AFB. In both diseases this smell depends on which secondary bacteria infest the larval remains after death

.Prevent and control

- Controlled by antibiotics (oxytetra coding & ethyl oxide fumigation)
- Proper sanitary management and yearly brood comb renewal are most preventive methods
- Try to remove the cause of stress, and boost the colony’s efforts to build up, perhaps with a frame of brood and bees, if possible. If the disease is not too far gone, then all should be well. There is no need for chemicals.

C. Sacbrood

Sacbrood is a viral disease (*Morator aetatulae*) that does not usually cause severe losses. It mainly occurs early in the brood-rearing season when the ratio of brood to bees is high. Most beekeepers don’t notice it mainly because it affects a small percentage of larvae only. Adult bees detect and remove infected larvae very quickly and so, if the beekeeper does notice the problem, this is usually because it has progressed to a stage where the workers can no longer control it. Therefore, by the time the beekeeper observes the symptoms, the disease may be too severe for the adult worker population to handle. Both worker and drone larvae are affected. Pupae may be killed occasionally, but adult bees are immune to it. Dead brood is often scattered among healthy brood. Nurse bees are suspected of transmitting the disease by carrying the virus from cell to cell. It is also believed that robber bees spread the disease by taking contaminated honey from one colony

Page 93 of 124	Holeta PTC Author/Copyright	Animal production Level III	Version -3
			Jun, 2021



to another. The spread of this disease is another reason why drifting and robbing should be prevented. Fig. 26. Sac

- Caused by virus known as popcorn
- The larvae unable to make its final mole
- When affected larvae is carefully removed from its cells it appears as sac filled with water retarded head dep't

Prevention and treatment (control)

- No chemotherapeutic treatment
- Controlling measures- only sanitary management

D. Chalk Brood

Chalkbrood is a disease caused by the fungus, *Ascosphaera apis*, and it affects unsealed and sealed brood. It can be triggered by a change in brood-nest temperature. When there are insufficient nurse bees to cope with extreme weather conditions (e.g. for cold clustering and heat fanning), the brood may be left unattended. The first larvae affected are usually those around the edges of the brood, where the brood temperature may be higher or lower.

Stress of any kind can result in chalkbrood: high or low temperatures, wet or dry conditions, an increase in CO₂, poor nutrition, a failing queen, poor hive management and moving hives. In other words, all sorts of environmental factors have been linked to the disease at one time or another, which means the trigger is not completely understood.

- Commonly a disease of worker and drone larvae
- The larvae die after they have been sealed in their cells
- Its pathogenesis and epidemiologist is not well understood

Prevention and control treatment

- no satisfactory chemotherapeutic treatment
- Burning excessively infected brood combs

E, stone brood –similar to chalk brood

- Caused by fungus which kills both larvae & Adult HBS

Page 94 of 124	Holeta PTC Author/Copyright	Animal production Level III	Version -3
			Jun, 2021



- No successful treatment has been developed for it

2.2.2. Adult Honey Bee diseases

A. Nosema

Nosema apis is a unicellular parasite of the class of Microsporidia that is now considered to be a fungus. N. apis has a resistant spore that can withstand temperature extremes and dehydration. It is a very widespread disease of honey-bees and, when the spores are eaten by adult bees, they germinate and invade the gut wall. Here they multiply and produce more spores that are passed out in the waste..

Prevention and control measures

Nosema is common in spring and autumn, and many beekeepers treat the condition with an antibiotic substance called fumagillin (the tradename of which is Fumadil B), added to an autumn feed of sugar syrup. Fumadil B(prepared from Aspergillus fumigatus, the causative agent of stone brood!) inhibits the spores reproducing in the ventriculus, but it does not kill them

B. Amoeba

- Caused by protozoa known as malpighamoeba mollified
- The honey bees become infested by ingesting the cysts that germinates in the gut and feed externally on the cells

Prevention and control measures

- Pod not require chemical treatment
- Corrected by improving management by feeding, cleaning and strengthening of colony

C. Acarine Disease

- Caused by microscopic mites called Acaroids woody
- This parasitic mites live in tracheae (breathing system of bees) it enters with gas exchange so that the bees unable to fly i.e crawling leaving their nest & die out side

Prevention and control measures

Page 95 of 124	Holeta PTC Author/Copyright	Animal production Level III	Version -3 Jun, 2021
----------------	--------------------------------	--------------------------------	-------------------------



- Dram the bee colony and burn them

D. Varroa mites

- Caused by parasitic mites known as varroa Jacobson
- An external parasite of honeybees and most commonly attached on between thorax and Abdomen, between abdominal segments and b/n head and thorax and can be seen by necked eye
- The mite can simply penetrate and the enter segmental membrane and ingest the blood frequently

Pre venation & control measures

- No treatment during brood rearing but fumigate with tobacco smoke (3gm tobacco) for brood

E. Bee paralysis

- Caused by virus called chronic paralysis virus (CPR)
- The symptom as result of infection is Abnormal trembling motion of wings bodies of adult bees
- Bloated abdomen is not seen and dislocated wings are seen in hive
- Found in all countries except Africa

Page 96 of 124	Holeta PTC Author/Copyright	Animal production Level III	Version -3
			Jun, 2021



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

Directions: Answer all the questions listed below.

1. Which one of the following is not an adult honey bee disease? (2pts)
A. Nosema Disease B. AFB Disease C. Amoeba D. None of the above (2pts)
2. Which one of the following is caused by parasitic mite (2pts)
A. Bee paralysis B. Acarapis wood C. Varrao mites D. all
3. The disease caused by bacteria are _____? (2pts)
A. AFB B. EFB C. Varrao mites D. A and B

Note: Satisfactory rating – 6 points Unsatisfactory - below 6points

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



Information sheet 3- Observing flight paths around hive entrance

3.1. Observing and recording whole flight paths

Recording whole flight paths since a forager trained along a route to a feeder chooses the direction it would have taken if not being transported to an unexpected site, it was concluded that the bee applies an egocentric reference in navigation. The bee would be lost if it did not find back to the hive by steering towards a beacon at the hive or some other procedures of localizing the hive

3.2. Why do bees roll around on the ground

The bees on the ground could be bees that have outlived their usefulness and have been expelled from the hive or just don't have the strength to fly back into the hive. ... Bees will boot drones out if there are too many or if it is getting late in the season and nectar and pollen are scarce.

3.3. The dead or dying bees

Lots of dead bees outside the hive can indicate a number of factors including starvation, pesticide poisoning, disease, moisture, etc. Lots of dead bees inside the hive can also indicate a number of things as well, winter kill, starvation, pesticide, disease.

Most or all hives in an apiary may be affected. Dead adult bees often have their wings unhooked and at odd angles to their body, their proboscis fully extended, and their hind pair of legs outstretched behind them. A lack of foraging bees can be observed leaving the hive.

If your bee isn't wet or cold or not obviously injured, it may have some issue you can't see. It may have a disease, a parasite, or some injury you can't detect. Likewise, a bee may simply be dying of old age. Signs of age included ragged wings and a loss of hair, making her look especially shiny and black.

Page 98 of 124	Holeta PTC Author/Copyright	Animal production Level III	Version -3 Jun, 2021
----------------	--------------------------------	--------------------------------	-------------------------



11.2. Recording whole flight path

Since a forager trained along a route to a feeder chooses the direction it would have taken if not being transported to an unexpected site, it was concluded that the bee applies an egocentric reference in navigation. The bee would be lost if it did not find back to the hive by steering towards a beacon at the hive or some other procedures of localizing the hive

Page 99 of 124	Holeta PTC Author/Copyright	Animal production Level III	Version -3
			Jun, 2021



Self-Check -3	Written Test
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Directions: Answer all the questions listed below.

1. What is the importance of observing the flight path of honey bees?(4pts)
2. Lots of dead bees outside the hive can indicate a number of factors. Mention them?
(4pts)

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

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

Page 100 of 124	Holeta PTC Author/Copyright	Animal production Level III	Version -3
			Jun, 2021



Information sheet 4- Implementing biosecurity measures in the Apiary site

4.1. Biosecurity and its importance

Farm-level biosecurity is a series of management practices that are designed to minimize the introduction and spread of disease-causing pathogens, parasites, insect pests, and predators (referred to collectively as “pests”) onto, within, and beyond the farm. An effective biosecurity program is based on the understanding and application of measures to minimize the transmission of pests in animal and plant populations, including their introduction (bio exclusion), spread within the populations (bio management), and release (bio containment). When a component of the program has a weakness, or where biosecurity measures are not fully implemented, it provides a route by which pests might enter or remain in a bee population. The risk of exposure of healthy bees to pests occurs when infected or infested bees, contaminated equipment, or feed are introduced to an operation. This can occur through intentional introductions or unintentional mixing of bees from other operations. Within an operation, pests can be spread through handling or sharing of water, feed and pollen sources.

4.2. Measure to be taken in the apiary site

Training, monitoring, preventative management practices (including equipment and facility design), and timely treatment interventions are necessary to mitigate these risks.

4.3. Benefits of biosecurity management

Some of the benefits of enhanced biosecurity management to the industry and individual honey beekeeping operations may be:

- improved food security through the supply of healthy crop pollinators
- better honey production and pollination by stronger colonies
- reduced losses and economic impacts from pests

Page 101 of 124	Holeta PTC Author/Copyright	Animal production Level III	Version -3
			Jun, 2021



- reduced risk of exposure, introduction and spread of pests
- saving time and money on treatments and pest management
- improved domestic and international market-ability of honey bees and bee products
- possible continuation or early resumption of inter-provincial and international trade in the event of a serious outbreak
- a marketing advantage if selling used equipment or providing pollination services
- improved treatment efficacy and pest management effectiveness
- reduced chance of developing treatment resistance
- reduced chance of devastation from introducing a new biosecurity risk

Page 102 of 124	Holeta PTC Author/Copyright	Animal production Level III	Version -3
			Jun, 2021



Self-Check -4	Written Test
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Directions: Answer all the questions listed below.

1. The risk of exposure of healthy bees to pests occurs when _____ are introduced to an operation?(2pts)
2. A. Infected or infested bees B. Contaminated equipment, or feed. C. mixing of bees from other operations D. All
3. Mention the relationships between plants and honey bees?(4pts)
4. Mention some of the benefits of enhanced biosecurity management to the industry and individual honey beekeeping operations. (4pts)

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

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



Information sheet 5- Recording and using results of inspection

Record Keeping

Record keeping is essential to monitoring for pests and diseases. Retain a record of the following information:

1. apiary and colony identifier
2. date of inspection
3. person who inspected/monitored
4. colony strength rating
5. honey production
6. visual observations of bee health and behavior
7. visual observations of signs of pests
8. visual observations of disruption, comb, or hive box damage
9. spore or parasite counts, and sampling method used
10. Notes on new biosecurity risks in the area

Recording for monitoring may be done on a hive-by-hive basis or for the whole apiary if a sample of hives is regularly monitored

Page 104 of 124	Holeta PTC Author/Copyright	Animal production Level III	Version -3
			Jun, 2021



Self-Check -5	Written Test
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Directions: Answer all the questions listed below.

1. Mention some of the retained record keeping system which is essential to monitor pests and diseases (4pts)

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

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



Operation Sheet - Colony inspection to assess pests and diseases

1. Preparing the smoker
2. Wearing protection cloth
3. Approach the bees on the side or at the back
4. Put a good quality / gentle smoke to the to subdue the bees wait one or two minutes for the smoke to penetrate the corners of the hive to ensure that the disorganization of the colony is complete before opening the hive
5. Open the hive by lining the top bars or frames one by one puff smoke through the little gap in to the hive when you are holding the comb always hold it vertically .if you hold it horizontally it is likely to break off and much harm is done
6. After inspecting the comb replace the comb in the same order as you took them out try not to squash bees.
7. After completing your work with bees, the fire in the smoker should be carefully eliminated in order to avoid fire hazards
8. Record what you have seen in the colony according to your objectives. It may be one or more of the listed below
 - ✓ the presence of queen
 - ✓ The presence of eggs and larvae
 - ✓ The brood patten –shows strength of the queen
 - ✓ The strength of colony –strong colony has high population of bees
 - ✓ The swarm preparation – observing of queen / swarm cells
 - ✓ The presence of disease and pest attack and other conditions



LAP Test	Colony inspection to assess pests and diseases
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Name: _____ Date: _____

Time started: _____ Time finished: _____

Instructions: Use personnel protective equipment,
Given necessary templates tools and materials you are required to perform the following
tasks within **2** hours.

Task: conduct colony inspection



LG # 72	LO6. Assess honey bee flora
Instruction sheet	
<p>This learning guide is developed to provide you the necessary information regarding the following content coverage and topics –</p> <ul style="list-style-type: none"> • Carry out identification of honey bee flora • Confirming Bee floral calendar • Assessing a basic nutritional need of honey bee • Identifying conditions affecting plants for honey bee visiting <p>This guide will also assist you to attain the learning outcome stated in the cover page. Specifically, upon completion of this Learning Guide,</p> <p>you will be able to –</p> <ul style="list-style-type: none"> • Carry out identification of honey bee flora • Confirming Bee floral calendar • Assessing a basic nutritional need of honey bee • Identifying conditions affecting plants for honey bee visiting 	
Learning Instructions:	
<ol style="list-style-type: none"> 1. Read the specific objectives of this Learning Guide. 2. Follow the instructions described below. 3. Read the information written in the “Information Sheets”. Try to understand what are being discussed. Ask your trainer for assistance if you have hard time understanding them. 4. Accomplish the “Self-checks” which are placed following all information sheets. 5. Ask from your trainer the key to correction (key answers) or you can request your trainer to correct your work. (You are to get the key answer only after you finished answering the Self-checks). 6. If you earned a satisfactory evaluation proceed to “Operation sheets 7. Perform “the Learning activity performance test” which is placed following “Operation sheets” , 8. If your performance is satisfactory proceed to the next learning guide, 9. If your performance is unsatisfactory, see your trainer for further instructions or go back to “Operation sheets”. 	



Information sheet 1- Carry out identification of honey bee flora

1.1. Identification of plants, which benefit Honeybees

Honey plants are destined as plant Flowers that yield nectar and /or pollen or honey dew from which bees produce honey

Ethiopia is potentially rich with diversity of plant habitat. Some of the honey plants are dominate in highland and others in lowland. There are also cultivated crops forage plants horticultural plants in different areas, which provide ample nectar and pollen for foraging honeybees

1.2. Recognizing plant and Bee relationship

1.2.1. Benefit of plants to bees

Honey plants are home for bees after basic nutritional requirement these nutritional requirements are nectar and pollen. Honey plants can be pollen yielder. Nectar yielder or pollen and nectar yielder

Nectar is the main energy source for flight and used for the preparation of honey

Pollen is the main protein source that enables bees to build up their body tissues.

B. Pollen yielders

Some plants provide pollen to the bees said to be pollen yielder these can be classified as major & minor source based on the forage attendance over a period of time e.g. stereopermum prunus persica Hagenia abyssinica) minor source (Eucaly puts citri- odoria)

C. Nectar yielder

Minor nectar source –are plants visited by the bees less often or only when flowers of major nectar source plants are not available or flowers which do not meet the demand of bees visited under extra ordinary condition.) eg solanium spp

Page 109 of 124	Holeta PTC Author/Copyright	Animal production Level III	Version -3
			Jun, 2021



D. Pollen and nectar yielder

Are plants provide both nectar and pollen to bees The plants may provide abundant nectar and less pollen or they may provide abundant pollen and less nectar

1.2.2. Benefit of plants to the Environment

Promoting beekeeping is one of the major area to protect and improve the plant resource. Bees improve the plant resource by pollinating natural plant habitat. Plant will continue its natural cycle and man also plants various species of plants for the sake of keeping his bees and for honey production. In the process man is changing his environment with plant resource

Page 110 of 124	Holeta PTC Author/Copyright	Animal production Level III	Version -3
			Jun, 2021



Self-Check -1	Written Test
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Directions: Answer all the questions listed below.

1. Those plants which provide both nectar and pollen to bees are: (2pts)
 - A. Pollen Yielder
 - B. B. Nectar yielder
 - C. Both nectar and pollen yielder
 - D. all of the above
2. Nectar is source of :
 - A. energy
 - B. carbohydrate
 - C. from which honey is made up of
 - D. all are correct
3. Justify how promoting beekeeping is one of the major area to protect and improve the plant resource (4pts)

Note: Satisfactory rating – 10 points

Unsatisfactory - below 10 points

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

Page 111 of 124	Holeta PTC Author/Copyright	Animal production Level III	Version -3
			Jun, 2021



Information sheet 2- Confirming Bee floral calendar

2.4. Bee floral calendar

A calendar for beekeeping is a time-table that indicates the approximate date and duration of the blossoming periods of the important honey and pollen plants to the beekeepers in their respective areas. The experienced beekeepers usually acquire much of this information over the years, but published charts are important for all beekeepers to use (FAO, 1990). Assembling a beekeeping calendar for any specific area requires complete observation of the seasonal dynamics in the vegetation patterns and/or agro-ecological zones, the foraging behavior of the bees, and the manner in which the honeybee colonies interact with their floral environment. The accuracy of a beekeeping calendar, and hence its practical value, depend solely on the careful recording of the beginning and end of the flowering season of the plants and how they affect the bees.

There is a lack of information about a national beekeeping calendar that relates the flowering of honeybee forage plants to honey flow and harvesting seasons. Seasonal weather affects nectar and pollen resources, which in turn affect the colony population. Reduced food means that the queen lays fewer eggs and the population of the hive falls. Increased food means an increased number of eggs and larger population.

2.2. Approximate date and duration of the blossoming periods of the important honey bee flora

The floral calendar of different honey plants vary from place to place and the type of plants also different. Some of the honey plants are dominate in highland and others in lowland. There are also cultivated crops forage plants horticultural plants in different areas, which provide ample nectar and pollen for foraging honeybees depending on the conduciveness of weather condition. The diversity and species mixtures that gives flower throughout the year are very important

Page 112 of 124	Holeta PTC Author/Copyright	Animal production Level III	Version -3
			Jun, 2021



Self-Check -2	Written Test
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Directions: Answer all the questions listed below.

1. Assembling a beekeeping calendar for any specific area requires :(2pts)
 - A. complete observation of the seasonal dynamics in the vegetation patterns and/or agro-ecological zones,
 - B. the foraging behavior of the bees, and
 - C. the manner in which the honeybee colonies interact with their floral environment.
 - D. All of the above

2. The accuracy of a beekeeping calendar and hence its practical value depend solely on (2pts)
 - A. careful recording the beginning
 - B. careful recording of the end of the flowering season of the plants and
 - C. How they affect the bees.
 - D. All are correct

3. Seasonal weather affects (2pts)
 - A. Nectar production
 - B. Pollen resources
 - C. Colony population.
 - D. All are correct

Note: Satisfactory rating – 6 points Unsatisfactory - below 6 points

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

No	Plant spps	Common (local)	Flowering pe- riod
			
1	Mangifera indica	Mango (Eng.Amh&ora)	Dec-mar
2	Rhusglutinosa	Tatesa (or)	Oct-janu
3	Schinus molle	Tikur-berberie (Amh)	Jan-Dec
4	Polyscias fulva	Yegenjero wenber(Amh) talgo(or)	Non -Apr
5	Schaffer Abyssinia	Geteme (Amh) marfatu(oro)	Mar-may
6	Veronicas amygdaline	Grawa(Amh) Ebicha (oro)	Jan-Feb
7	Jacarand a mimosifolia	Yetemenja zaf(Amh)--	Non-may
8	Stereospermum kun thi- anum	Zana (Amh) Botoro(oro)	Sep-may
9	Adansonia digitata	Bambo (Amh)-----	May-july
10	Cordia africana	Nanga /waddesa(oro)	Oct-may
11	Buddleja polystachya	Atikuar(Amh)chei lor	Non-may
12	Boswellia papyrifera	Yeitan-zaf(Amh)kafal(oro)	Oct-mar
13	Opantia ficus-indica	Kwkual -----	Janu-Dec
14	Combretum molle	Didessa (oro)	Janui-Aprit
15	Euphorbia abyssinica	Kulkual (tulu)	Sep-Nou
16	Coroton macrostachys	avocado	APR-Iul
17	Dovalis abyssinica	Koshm(Ankakutch) oro	Oct -Feb
18	Persea americana	avocado	Oct-Dec
19	Acacia spps	Girar	Varies from spps to spps
20	Albize spps	Sisa /mukarbe	//
21	Erythrius abyssinica	Kore(Amh) walensu(oro)	Sep-April
22	Azadirachta indica	Neem tree	Oct-march
23	Ekebergia capensis	Lol(Amh) walensu(oro)	Nov-may



24	Ficus vasta	Warka (Amh) –kiuta (oro)	Oct-Dec
25	Ficus sur	Shoal(Amh)arbu (Or0)	Oct-Dec
26	Eculyptas spp	Bar-zar	March-Apri
27	Masax paradisiaca	Muz(Amh)&oro) bakana	Januy-Dec
28	Psidium guajava	dokima	Janu-Dec
29	Syzygium guineese	dokina	Janu-March
30	Dlea spp	Weyira /Ejersa	April tojane(varies)
31	Coriandrum sativum	Dimbcāl(Amh)	Jan-Dec
32	trachyspernumamini	Nech Azmud(Amh)	Oc-Dec
33	Carissa edulis	Agam(Amh)Agamsa(oro)	Jan-Dec
34	Bidens spp	AdeyAbeba (Amh)kelo Abare(oro)	Sep-oct
35	Carthamus tinctorius	Sunflower suf	Nov-Feb
36	Guizotia spp	Nvg Hada,tufo	Aug-Feb
37	Brassica napus	oilseed	Sep-Nov
38	Brassica nigra	Senafch	Sep-Aprl
39	Lapidium sativum	Feto(Amhxoro)	Oct-Nov
40	Chat edulis	Chat (Amh) jima(oro)	Sep-Dec
41	Cobretus paniculatus	Begi(e) (oro)	Sep-Dec
42	Cucurbita pepo	Duba (Amh)	Apr-Dec
43	Ocimum lamiifolium	Dama kasie (Amh)	Apr-Dec
44	Ocimum urticifolium	Besobla[amh.]	Jan- Dec
45	Salviani lotica	Besobila[Amh.]	Sept-Dec.
46	Saturej paradosca	Naddo (Amh) tenadam(oro)	Sep-Dec



47	Thymus schimperi	shimbra	Jan-Dec
48	Ciceraritinum(Chikpea	Shimbra	Oct --Feb
49	Trifolium spps	Megat,Wazma(Amh.) ,Sidisa(Orom.)	Variable
50	Vacia faba	Bakela	Sep-oct.
51	Vacia dassyycarpa	Vech	Apr-Dec.
52	Forage Legumes	Different	Sep.-Dec
53	Linum usltatissimum	Telba(Amh.)	Oct-Nov
54	Solanium Tuberosum	Dnich(Amh.)	-



Information sheet 3- Assessing a basic nutritional need of honey bee

3.1. Introduction

Honey plants are home for bees after basic nutritional requirement these nutritional requirements are nectar and pollen. Honey plants can be pollen yielder. Nectar yielder or pollen and nectar yielder

Nectar is the main energy source for flight and used for the preparation of honey. In this honey, there are important nutrients like sugar, minerals, vitamins, water/moisture acids which full fill the nutritional need of honey bees

Pollen is the main protein source that enables bees to build up their body tissues

3.2. Feeding of Honey bees according to their nutritional need

Honey bees do not need to be fed regularly as other livestock does but there are occasions when supplementary feed is required

The occasions are

- Bad weather, which prevent the bees from forage during nectar flow.
- Newly established natural swarm for making comb and brood rearing
- Hive manipulation such as inspection, uniting queen rearing
- Dearth period both rainy season and complete dry season
- Colonies used for pollination on crops that do not provide much nectar
- Price difference between honey and sugar
- Stimulation of brood rearing in order to increases the population in anticipation of active season of nectar flow
- Counter balance for pesticides and herbicides damage

3.3. Why we feed honeybees?

Page 117 of 124	Holeta PTC Author/Copyright	Animal production Level III	Version -3
			Jun, 2021



Feeding a small colony will stimulate the queen to lay more eggs. This can ensure much brood to be reared. This type of feeding is called simulative feeding

Manipulative feeding. This is used when some particular hive operation is carried out such as queen rearing inspection etc if the bees are fed either before or after the operation they are guided to the special manipulation

supplementary/ emergency / feeding

At certain time pollen shortage can retard colony development during such time sugar syrup or honey would not materially improve the condition. The honeybees must have a supply of pollen readily available to restore the depletion of food in the hive

The causes of deficiency of food in the hive

A sudden change or stop of a nectar flow

- Due to the beekeepers/ when he removes the whole honey
- During chemical application

3.4. When to feed honeybees

There are some periods when it is necessary to feed bees in Ethiopia

3.4.1. During heavy rainy

- Nectar in the field is diluted the sugar content become low &the bees do not forage
- Pollen is also soaked or washed away by the rain fall

3.4.2. During complete dry season of the year

Almost all surrounding honey plant flower will be dried so no more flower gives nectar and pollen

3.5. What to feed honeybees

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

3.5.1. **Honey** - is the first choice for honeybees provided it is free from diseases spores

It is a natural &their own product so the principal food stuffs of honeybees

Page 118 of 124	Holeta PTC Author/Copyright	Animal production Level III	Version -3 Jun, 2021
-----------------	--------------------------------	--------------------------------	-------------------------



3.6.2. Sugar syrup

This is prepared by dissolving ordinary table sugar (sucrose) in water the ratio of sugar to water is depend on the objective or type of feeding

Precaution: - the warm dissolved sugar syrup has an aroma that induces or attracts robber bees so, it should never be given to honey bees, as it is warm i.e. cool and feed them

3.6.3. Pollen

Pollen is the male germ plasma of plant. The honeybees obtain the whole of its requirement of amino acid, vitamins; lipids and minerals from pollen, it can be fed either alone or mixed with honey

For this season beekeepers often trap pollen when it is abundant and feed them during periods of pollen shortage

3.6.4. Pollen substitute

Pollen substitute is any type that can be fed to bee colonies to replace its need for natural pollen. Among the most commonly used protein source from which pollen substitute can be prepared are soybean flour, brewer's yeast and dried skimmed milk

The recommended mixture (3:1:1)

3.6.5. Pollen supplement - this is a pollen substitute that contains about 10%of natural pollen (dry wt basis)

3.6.6. Candy is a forage like solid sugar used in bees feed at times when they will not take sugar syrup or when it is not possible to or un wise to use sugar syrup it is prepared by warm water dissolving of 3.2 kg of sugar in one litter of water

Page 119 of 124	Holeta PTC Author/Copyright	Animal production Level III	Version -3
			Jun, 2021



Self-Check -3	Written Test
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Directions: Answer all the questions listed below.

1. _____ is a pollen substitute that contains about 10% of natural pollen (dry w.t basis) (2pts)
A. pollen supplement B. pollen C. Pollen substitute D. Candy
2. _____ is a forage like solid sugar used in bees feed at times when they will not take sugar syrup or when it is not possible to or un wise to use sugar syrup (2pts)
3. Mention periods when it is necessary to feed bees in Ethiopia (4pts)

Note: Satisfactory rating – 8 points

Unsatisfactory - below 8 points

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



Information sheet 4- Identifying conditions affecting plants for honey bee visiting

4.1. Bee attraction plants

Bee attraction plants are plants which are visited by bees. The condition of plants affect honey bees not to visit the plants are:

- **Flower position** - should be suitable for the bees to land on it and manipulate the pollen and nectars easily
- **Flower color**- Bees find blue, purple and yellow flowers most appealing. Especially the corolla color should be white, yellow violent, blue or orange. Bees, like many insects, see from approximately 300 to 650 nm. That means they can't see the color red
- **Flower morphology** - Shape, arrangement, texture of corolla should be convenient for the bees to manipulate the flower.
- **High sugar rate (in nectar)** - their taste should reach the bees
- **Size and nature of pollen grain** - smaller and sticky nature of pollen grains are needed because honey bees do not collect and store in the comb cells that are dusty and larger sized pollen grains
- **Time of the day and activities of honeybees**

The opening and releasing of pollen and nectar secretion of the flowers should coincide with the activities of honey to be utilized by the worker bees.

4.2. Mutualistic

Bees and flowering plants have a mutualistic relationship where both species benefit. Flowers provide bees with nectar and pollen, which worker bees collect to feed their entire colonies. Bees provide flowers with the means to reproduce, by spreading pollen from flower to flower in a process called pollination.

Page 121 of 124	Holeta PTC Author/Copyright	Animal production Level III	Version -3
			Jun, 2021



Self-Check -4

Written Test

Directions: Answer all the questions listed below.

1. Mention the characteristic fulfilled by the honey plants to be visited by the bees

(5pts)

2. Bees and flowering plants have a mutualistic relationship where both species benefit. Explain how? (2pts)

Note: Satisfactory rating – 7 points

Unsatisfactory - below 7 points

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



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13. ISSN: 0005-772X (Print) 2376-7618 (Online) Journal homepage: <http://www.tandfonline.com/loi/tbee20>

Page 123 of 124	Holeta PTC Author/Copyright	Animal production Level III	Version -3
			Jun, 2021



Web sites

<https://www.beekeepingfornewbies.com/remove-bees-honey-harvest/>

<https://extension.arizona.edu/bee-informed-warming-swarming>

<https://www.honeybeesuite.com>

<https://www.perfectbee.com> › inspecting-your-hive › m..

<http://www.wbka.com> › wp-content › uploads › 2013/0

<https://extension.arizona.edu/bee-informed-warming-swarming>

Page 124 of 124	Holeta PTC Author/Copyright	Animal production Level III	Version -3
			Jun, 2021



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Page 125 of 124	Holeta PTC Author/Copyright	Animal production Level III	Version -3
			Jun, 2021



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