

Day 3

Review of Day 2

Session 11: Dividing a Colony

Session 12: Uniting Colonies

Session 13: Transferring Bees from a Traditional Hive to a Movable Frame Hive

Session 14: Artificial Diet and Comb Foundation and Management

Session 11 Dividing a Colony

Sub-topics

- ▶ Introduction
- ▶ Points to consider (colony status, bee population, queen, feed, season, time)
- ▶ Colony selection
- ▶ Preparation
- ▶ Methods for dividing
- ▶ Management of divided colonies

Time: 1 hour

Theory: 15 minutes

Practical: 45 minutes

Objectives

Trainees will be able

- to divide a colony and manage the divided colonies.

Training Methods

- Lecture
- Practical exercise
- Discussion and question and answer

Materials

- LCD projector and PowerPoint slides, diagrams, photos
- Movable frame hive with a strong colony of bees
- Empty hive
- Colony inspection equipment
- Queen/queen cell
- Feeder and sugar solution
- Comb foundation
- A whiteboard and board markers or blackboard and chalk
- A flipchart with stand and marker pens, or large sheets of brown paper with pens and masking tape

Activities and Exercises

Activity 1: Lecture

Give a presentation on the aim of colony division, and appropriate conditions and time for dividing a colony. Use slides and photos to illustrate the talk, or large blown up photos and diagrams in areas where there is no electricity.

Activity 2: Practical exercise

Step 1: Decide which method to use for colony division

Step 2: Explain the method step-by-step

Step 3: Ask two or three trainees to divide the colony step-by-step under your guidance as described in the resource material.

Activity 3: Discussion and question and answer

Use discussion and question and answer approaches to discover whether the trainees have clearly understood all the dimensions of colony division.

Take home message

- For commercialization of beekeeping, it is necessary to carry out colony division using queens or queen cells from selected colonies. This results in colony multiplication and genetic improvement.
- Colony division using emergency queens or queen cells leads to genetic erosion and reduces the honey productivity of the colony.

Session 11 Resource Materials

Dividing a Colony

Introduction

Colony division is a method of multiplying bee colonies, i.e., producing two or more colonies from a mother colony. Colony division is used to control swarming, as well as in commercial beekeeping to increase the number of colonies. The colonies can be used to increase the number of colonies in the apiary for honey production or sold for income. Colony division during the honey flow season can reduce honey production and it is necessary to decide whether division or honey production should have priority.

Points to Consider

Time/Season

Usually the best time for colony division is during the honey flow season. According to geographical location, colony division can be performed twice a year. For example, in foothill and plains areas, first between mid February and mid April and again between early October and early November. In the high hills of Nepal, it can be performed once between April and August. Commercial beekeepers can carry out artificial queen rearing and use the queens for colony division as needed.

Weather

- Colony division should not be performed in rainy or cold periods.
- The best days are reasonably sunny and warm.

Colony status

- The mother colony selected for division should be strong and healthy. A strong colony means 10 frames covered with bees of which 6 contain brood, and sufficient stored food (honey and pollen).
- The colony should have drones and queen cells.

Colony characteristics

Only the best colonies should be selected for multiplying. Selection should be based on the following characteristics:

- Egg laying capacity of the queen
- Honey and pollen collection capacity of the colony
- Good defensive behaviour and resistance to pests and disease
- Low tendency to swarm or abscond
- Capacity for rapid recovery of the population during the onset of honey flow, and able to maintain the population during the off season

Planning for Colony Division

Before dividing a colony, the mother colony should be selected, a decision taken on the time and season of division, and all the required materials collected together and prepared.

Equipment and Materials

- Empty hive including a dummy board
- A strong mother colony
- A frame fitted with comb foundation and empty comb
- Feeder/sugar
- Colony inspection equipment

Methods for Colony Division

Natural division using queen cells developed during swarming

The presence of multiple queen cells in a colony during the swarming season indicates a need for division. Dividing such colonies and using the queen cells in new daughter colonies can help control swarming. However, although it solves the immediate problem of swarming it does not help improve the genetic traits.

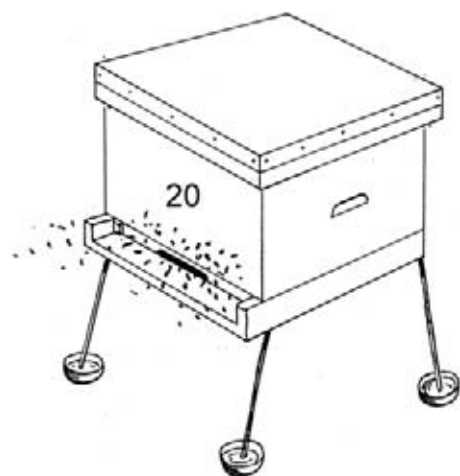
Colony division from queen production

Select the best colony based on the selection criteria given above. Produce queens from this colony before the onset of honey flow. These queens can be used to replace the old queen and to start new daughter colonies. The mother colony can be multiplied into several nucleus colonies (Figure 21) but each should have at least 2 brood combs and 3–4 combs with food (nectar and pollen). The prepared colonies can then be sold or migrated according to need.

The steps are as follows (Figure 49):

- Select the most appropriate mother colony.
- Move the hive about 1 foot (30 cm) to the left of the existing location.
- Place an empty hive about 1 foot (30 cm) to the right of the previous location, leaving the old location empty.
- Take 3 to 4 brood combs from the mother colony together with the existing queen and place in the empty hive.
- Keep 1 mature queen cell with 3 to 4 brood combs in the mother colony.
- Divide the combs with food stores equally between the hives. Remove any remaining queen cells.
- Divide the adult bees equally between the hives.
- Check whether the incoming foragers are entering both hives equally.
- If more foragers are entering one of the hives, move it further from the previous location and move the other hive closer to the previous location. Continue to adjust until equal numbers of foragers are entering both hives. Add frames with empty combs or comb foundation to the colony with the queen after colony division.
- Close and cover the hives.
- Divided colonies can be moved to the desired position by increasing the distance from the old position at a rate of 1 to 1.5 feet (30 to 45 cm) per day in the evening after the bees have stopped foraging.
- Divided colonies should be fed with sugar syrup in the evening for 3 days after division and comb foundation added as necessary.

Figure 49: Steps in colony division



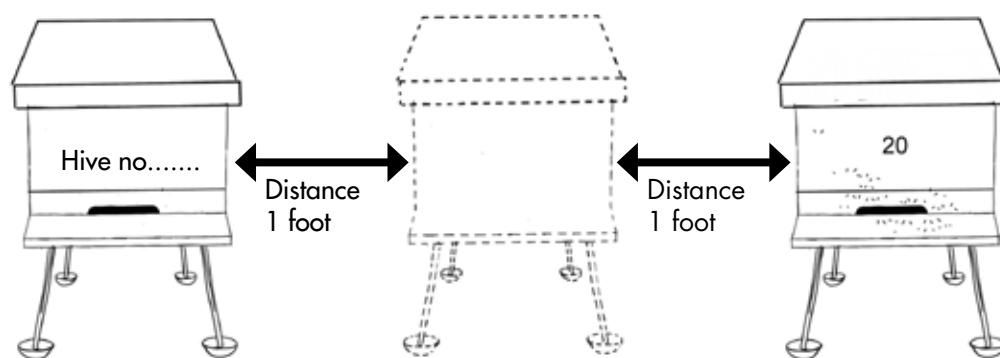
Step 1: Inspect the colonies



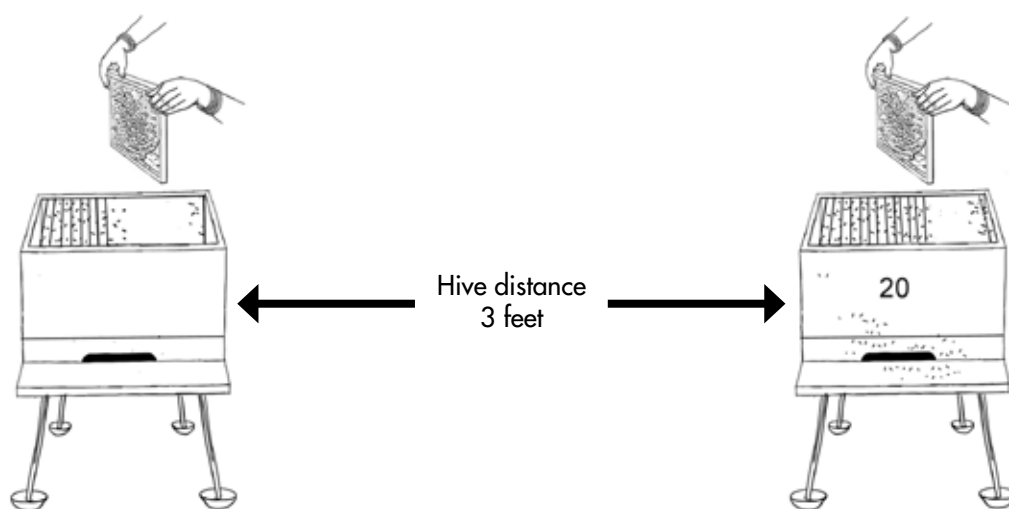
Step 2: Select the best mother colony

(Figure 49 continues)

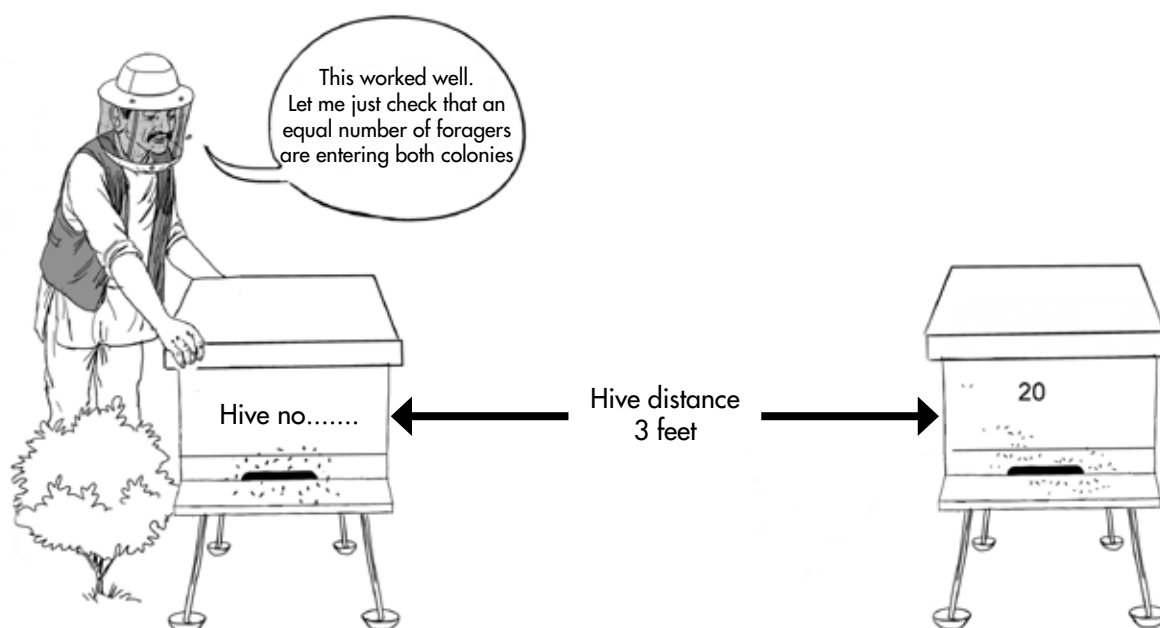
(Figure 49 continued)



Step 3: Move the mother colony 1 ft (30 cm) to the left and place an empty hive 1 ft (30 cm) to the right of the previous mother colony position. The hives are a hive width plus 2 feet apart



Step 4: Put 4 to 5 brood frames with the queen in the new hive



Step 5: Check the colony division is balanced and close the hives with the covers

Session 12 Uniting Colonies

Sub-topics

- ▶ Introduction
- ▶ Considerations (situation, time, and season)
- ▶ Preparation
- ▶ Method for uniting colonies
- ▶ Management of the united colony

Time: 1 hour

Theory: 15 minutes

Practical: 45 minutes

Objectives

Trainees will

- learn to unite honeybee colonies and manage the colony after uniting.

Training Methods

- Lecture
- Practical exercise
- Discussion and question and answer

Materials

- LCD projector and PowerPoint slides, diagrams, photos
- Two movable frame hives with weak bee colonies
- Honey and sugar syrup
- Colony inspection equipment
- A whiteboard and board markers or blackboard and chalk
- A flipchart with stand and marker pens, or large sheets of brown paper with pens and masking tape
- Metacards and pens, soft board and pins

Activities and Exercises

Activity 1: Lecture

Give a presentation on uniting colonies as outlined in the resource materials (below). Use slides and photos to illustrate the talk, or large blown up photos and diagrams in areas where there is no electricity.

Activity 2: Practical exercise

If the training is residential, do this in the evening.

Step 1: Ask trainees to select two weak colonies and inspect them.

Step 2: Explain the practical steps in uniting the colonies as described in the resource materials.

Step 3: Ask trainees to carry out the steps on their own, but under your guidance.

Activity 3: Discussion and question and answer

Use discussion and question and answer approaches to discover whether the trainees clearly understand how to unite colonies.

Take home message

- Uniting colonies results in a smaller number of strong colonies, which are more manageable, productive, and profitable than a large number of weak colonies.
- It is always better to maintain strong and healthy colonies for successful beekeeping.

Session 12 Resource Materials

Uniting Colonies

Introduction

Colonies are united to make a strong healthy colony from two (or more) weak colonies, or one weak and one strong colony, according to the needs of the beekeeper. Uniting the pheromones of two weak colonies results in the development over time of a new and single pheromone for the united, strong, and healthy colony.

The reasons for uniting colonies include the following:

- Weaker colonies: uniting weak colonies results in a single strong colony.
- Queenless colony or weak queen: If the colony doesn't have a queen, and no possibility of producing a new queen (no fertilized eggs or queen cells in the colony), the queenless colony should be united with a colony with a good queen (a 'queen-right colony').
- Worker laying: Sometimes worker bees may lay eggs if the time without fertilized eggs or a queen is too long. The laying workers should be removed as soon as they start egg laying and the remainder of the bees united with a queen-right colony.
- Inability of the queen to lay fertilized eggs: Occasionally a queen may not lay, or may lay only unfertilized eggs which become drones. This can happen under unfavourable weather conditions or when the colony has an emergency queen. Under such circumstances, the non-performing queen can be removed and the colony united with a queen-right colony.
- Increasing honey production: Two or more colonies can be united at the onset of the honey flow season to increase colony strength and maximize honey production.

Points to Consider

- All the foragers should have returned to the hive before colonies are united, thus it is best to unite them in the evening.
- One of the colonies selected for uniting should be made queenless before uniting it with a queen-right colony.
- Be careful not to lose bees from the queenless weaker colony while placing the hive on the paper barrier on top of the brood chamber of the strong queen containing colony (see method).
- Remove any laying workers from the queenless or weak colony.
- The paper placed between the two colonies should be perforated but able to prevent bees from passing through.
- A diseased colony should not be united with a healthy colony unless fully treated and recovered.

Uniting Colonies

Preparation

- Identify the colonies to be united.
- Bring distantly placed colonies closer before uniting. A weak colony can be brought close to the stronger, queen-right colony by moving at a rate of about 2 feet (60 cm) per day.
- Feed the colonies continuously with sugar syrup for 3 days before uniting if food stores are insufficient.
- Remove the queen of the weaker colony 24 to 48 hours prior to uniting.
- Remove all the empty combs and super/s from the colonies to be united during daytime.
- If laying workers need to be removed, the colony should be taken about 200 m away from its existing location and all the bees shaken off the comb before the hive is replaced in its original location. Only the bees that return to the original location should be united.
- Remove combs with worker eggs from worker laying colonies before uniting.

Method

The paper barrier method is the safest way of uniting colonies (Figure 50). A perforated paper is placed between the two hives (colonies) to be united. This allows mixing of the pheromones of the two colonies, resulting in a single united colony. Always unite the weak colony with the strong colony, not the strong with the weak.

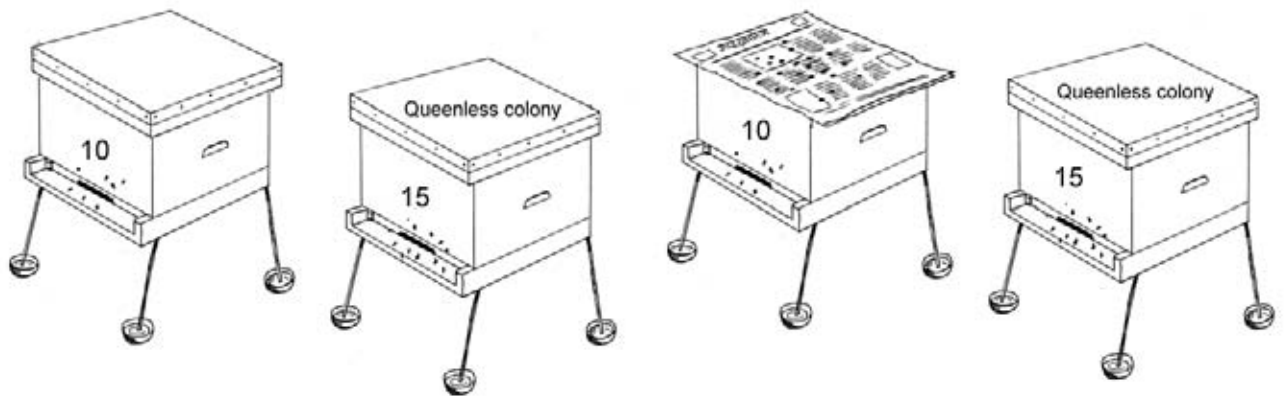
The steps are as follows:

- The colonies to be united should already have been moved close to each other (see above).
- Give a light puff of smoke at the entrances of the colonies.
- Remove the (outer and inner covers) of the queen-right (strong) colony and place a perforated paper over the frames to fully cover the brood chamber.
- Spread honey or 2:1 sugar syrup lightly on the paper
- Remove the bottom board of the queenless colony and place the hive on the perforated paper on top of the brood chamber of the queen-right colony. (The smoke will have encouraged the bees to withdraw to the combs so that there are no bees left on the bottom board.)

Management

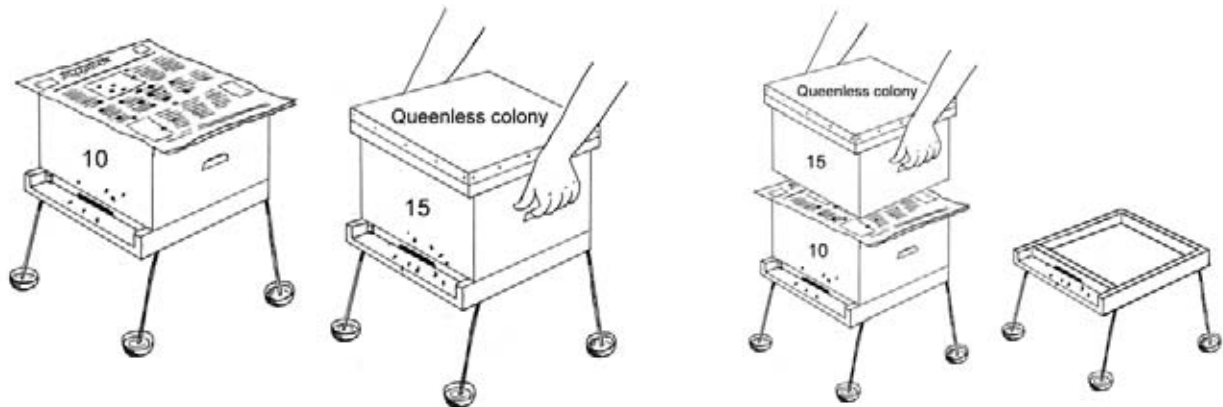
Honeybees from the colonies are united when the pheromones of the two colonies are thoroughly mixed by diffusion through the perforated paper. The bees will chew the paper from both sides; it will disintegrate within 48 hours and the bees will mix. The hive should then be opened and the bees and frames from the upper chamber transferred to the lower chamber so that all the bees are in one chamber. The united colony should be fed with artificial food for 3 days after removing the paper. If required, a super can be added after some days once the brood chamber is full and the united colony fully active, particularly during the honey flow season

Figure 50: The paper barrier method for uniting colonies



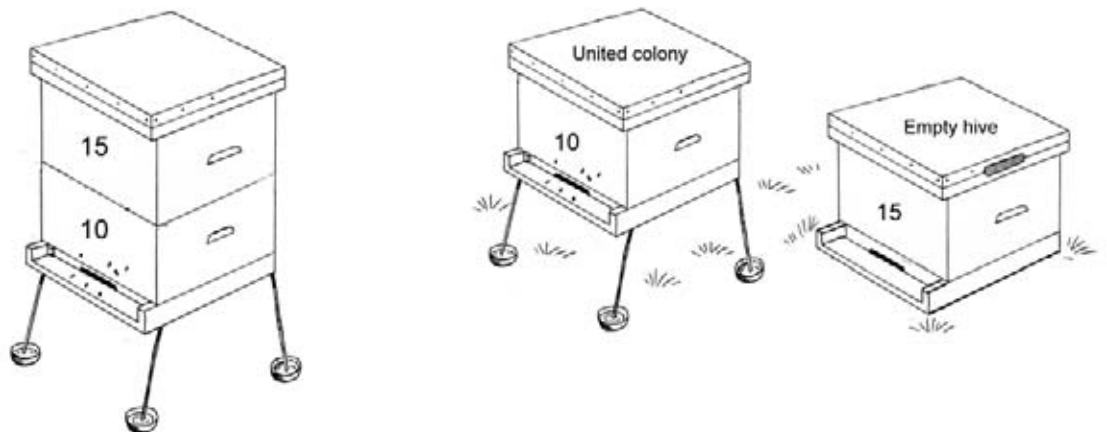
Step 1: Queen-right and queenless colonies moved close together

Step 2: Covers of queen-right colony removed and replaced with a sheet of perforated paper smeared with syrup or honey



Step 3: Queenless colony lifted from bottom board

Step 4: Queenless colony placed on sheet of paper above queen-right colony



Step 5: Pheromones of colonies allowed to unite while bees chew the paper

Step 6: After 2 days bees and frames from upper chamber transferred to lower chamber and covers replaced on the united colony

Session 13 Transferring Bees from a Traditional Hive to a Movable Frame Hive

Sub-topics

- ▶ Introduction
- ▶ Time and season
- ▶ Preparation
- ▶ Quality of the colony (status inside the hive, queen, drone, food, brood)
- ▶ Method of transfer
- ▶ Precautions
- ▶ Management of the transferred colony

Time: 2 hours

Theory: 15 minutes

Practical: 1 hour 45 minutes

Objectives

Trainees will

- be able to transfer a colony from a wall or log hive to a movable frame or modern hive, and
- be motivated to undertake modern beekeeping through management of transferred colonies.

Training Methods

- Lecture
- Practical exercise
- Discussion and question and answer

Materials

- LCD projector and PowerPoint slides, diagrams, photos
- Documentary film and poster
- Log or wall hive with bees
- Movable frame or modern hive
- Smoker
- Sharp knife, strong thread,
- Queen cage, queen gate
- Colony inspection equipment
- Mat or newspaper
- Flip chart or board
- A whiteboard and board markers or blackboard and chalk
- A flipchart with stand and marker pens, or large sheets of brown paper with pens and masking tape
- Metacards and pens, soft board and pins

Activities and Exercises

Activity 1: Lecture

Give a presentation on the method of transferring a colony from a traditional to an improved beehive and why it is important, and briefly describe the management practices for the transferred colony as outlined in

the resource materials (below). Use slides and photos to illustrate the talk, or large blown up photos and diagrams in areas where there is no electricity. You can show the 30 minute documentary film in the evening, before the session, or during the lunch break.

Activity 2: Practical exercise

- Step 1:** Explain the method of transferring a colony step-by-step from a log or wall hive to a modern hive as shown in the resource materials.
- Step 2:** Ask two or three trainees to try it themselves under the guidance of the trainer.

Activity 3: Discussion and question and answer

Use discussion and question and answer approaches to confirm that all trainees clearly understand the method of transferring a colony from a traditional to an improved hive, and the reasons why it is advisable.

Take home message

- Beekeepers can be motivated to undertake improved beekeeping with *Apis cerana* bees for income generation and employment by transferring the colonies from traditional to improved hives.
- The colony may abscond if transferred without proper technical skills or during the wrong season, and ignoring the basic requirements of the bees.

Session 13 Resource Materials

Transferring Bees from a Traditional Hive to a Movable Frame Hive

Introduction

In order to undertake commercial beekeeping and maximize profit, colonies must be transferred from traditional to modern hives to enable improved colony management practices to be applied. It is difficult to increase income from traditional beekeeping in log or wall hives because the amount of honey produced by bee colonies in traditional hives is very low and proper colony management is not possible. The main differences between the traditional and modern methods are summarized in Table 8.

Table 8: Differences between traditional and movable frame hives

Traditional hive	Movable frame hive
Less honey production	More honey production
Brood, combs, and adult bees are destroyed during honey harvesting; parts of these remain in the honey and reduce its quality.	Pure honey can be extracted using a honey extractor. The combs can be reused.
Not possible to use comb foundation or a honey extractor.	Comb foundation can be added to the hive.
Not possible to divide or unite colonies.	Colony division and uniting is possible.
Artificial feeding not possible.	Artificial diet can be given.
Colony migration is difficult.	Colony migration is easier.
Disease and pest control is difficult.	Disease and pest control is relatively easy.
Queen rearing and colony production is not possible.	Queen rearing and colony production is possible.

Transferring a Colony

Preparation

Collect together and prepare all the necessary materials before transferring the colony from a traditional hive to an improved hive. Materials include the wall or log hive with bees, an empty movable frame hive, colony inspection equipment, sharp knife, thread, and a queen cage. It is important to have a helper. The colony should be transferred during the day in the warm honey flow season.

Colony quality

The colony to be transferred should have the following qualities:

- Strong queen-right colony
- Sufficient drones
- Sufficient stores of nectar and pollen
- Sufficient brood in the comb
- Healthy
- Active (favourable) beekeeping season

Precautions

The following precautions should be taken:

- Use smoke.
- Use a bee veil.
- Use a sharp comb-cutting knife.

- Use strong string to bind the comb.
- Combs should be adjusted within the frame and not attached to each other, and frames should fit tightly in the hive.
- The brood or honey comb should be fitted tightly onto the top bar.
- Be sure to hive the queen and all the bees.
- If the queen is found during colony transfer she should be caged and kept in the modern hive, and released after transferring the colony; the cage should then be removed.
- Hide the old hive and keep the modern hive in the place where the traditional hive was previously; use a queen gate to prevent the queen leaving.

Steps in colony transfer

Colony transfer should be completed as quickly as possible. It should be carried out during the day when bees are out foraging. The steps are listed below and illustrated in Figure 51.

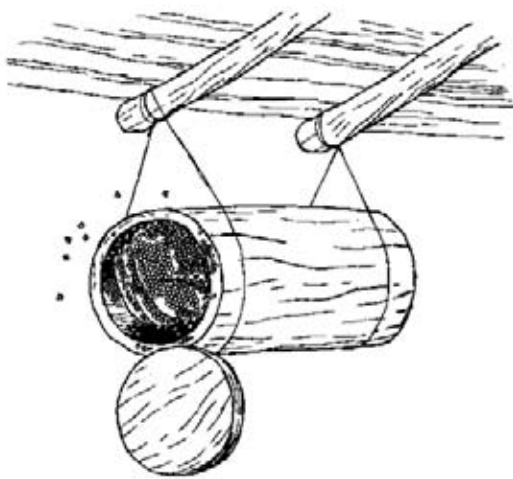
- Collect up the materials needed and place close to the traditional hive.
- Blow a light puff of smoke into the hive entrance.
- Slowly open one of the lids to the right or left of the hive entrance.
- Blow more smoke into the entrance to encourage the bees to leave the combs and cluster elsewhere in the hive.
- Cut a comb from the traditional hive holding it in one hand; do not let it fall or break. Brush off any bees remaining on the comb onto paper or into the new hive.
- Cut the comb to fit in the frame removing the honey storage portion. Take care not to damage the brood while cutting and framing the comb.
- While fitting the comb in the frame, place both the wires of the frame into the comb by making a shallow furrow with a knife on the face of the comb.
- Tie the comb to the frame at both sides so that it will not swing, and place the frame in the hive.
- Repeat the procedure with each comb one-by-one until all the combs are fitted into frames and placed in the modern hive.
- Transfer the clustered bees (colony) gently by hand from the traditional to the modern hive. Ensure that the queen is transferred to the new hive.
- Place the inner and outer covers on the hive.
- Place the modern hive with the bees in the place where the traditional hive was before. Face the entrance in the direction that the traditional hive entrance was facing.
- Brush any remaining bees from the log hive onto a mat or newspaper spread on the ground together with any bees brushed off the old combs.
- Look carefully for the queen, if she has been dropped on the mat, capture her safely and put her in the hive.
- Place the mat or paper with brushed off bees next to the new hive entrance so that the bees can enter. Hide the log some distance away.
- Again look carefully for the queen, if she has been dropped on the ground, capture her safely and put her in the hive.
- If the traditional hive was a wall hive, blow smoke into it and seal the hive and entrance completely after all the bees have flown out.
- Once you are sure that the queen is in the modern hive, install a queen gate so that she cannot leave.

Management of the transferred colony

After the colony has been transferred from a traditional to a modern hive do the following:

- Use a queen gate.
- Use a dummy board if there are less than 8 combs.
- Continue feeding sugar syrup in the evening for 3 days.
- Clean the hive after 3 days, and cut and remove the strings from around the combs.
- Remove any empty combs and replace the frames with frames containing foundation.
- Check whether the queen is laying.
- Do not disturb or handle the bees unnecessarily.

Figure 51: Transferring a bee colony from a traditional log hive to a movable frame hive



a) opening one of the lids



b) puffing smoke into the hive



c) removing a comb after cutting it inside the hive



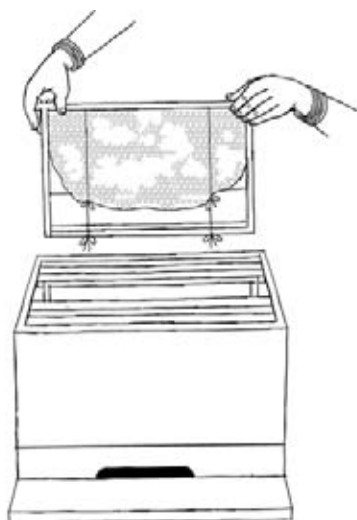
d) cutting away the honey storage area and framing the brood bearing part of the comb



e) making shallow grooves on the face of the comb with a knife to fit the wires of the frame



f) tying the combs on both sides with string to prevent swinging



g) fitting the frames with tied comb into the modern hive



h) transferring the clustered bees from the log hive to the frame hive



i) filled hive ready to close



j) placing the modern hive where the traditional hive was before and facing in the same direction



k) brushing any remaining bees from the empty log hive onto a mat or paper on the ground



l) inspecting the area to see if the queen is on the mat or floor



m) placing the bees from the mat or paper next to the hive

Session 14 Artificial Diet and Comb Foundation and Management

Sub-topics

- ▶ Introduction
- ▶ Types of artificial diet and method of preparation
- ▶ Feeding honeybee colonies
- ▶ Storage of comb foundation and method of use

Time: 1 hour 30 minutes

Theory: 30 minutes (two presentations of 15 minutes each)

Practical: 1 hour

Objectives

Trainees will

- understand the importance of and need for an artificial diet,
- know about different types of artificial diet,
- be able to prepare an artificial diet and feed it to a colony,
- understand the importance of comb foundation and how it is used in modern beekeeping, and
- know how to fit and manage comb foundation.

Training Methods

- Lecture
- Practical exercise
- Discussion and question and answer

Materials

- LCD projector and PowerPoint slides, diagrams, photos
- Movable frame hive with bees
- Colony inspection equipment
- Sugar
- Water
- Soya flour
- Honey
- Plate or cooking bowl
- Pot for preparing syrup (jug, bowl)
- Plastic or frame feeder
- Empty frame
- Comb foundation
- Knife
- Small wooden tool
- Match box
- Candle or melted wax
- A whiteboard and board markers or blackboard and chalk
- A flipchart with stand and marker pens, or large sheets of brown paper with pens and masking tape
- Metacards and pens, soft board and pins

Activities and Exercises

Activity 1: Lecture

Give a presentation on the importance and need for an artificial diet, different types of diet, preparing syrup, candy, and pollen substitute, and feeding methods as outlined in the resource materials (below). Use slides and photos to illustrate the talk, or large blown up photos and diagrams in areas where there is no electricity.

Activity 2: Practical exercise

Trainees learn how to make three different types of artificial food.

Preparation of syrup

- Step 1:** Collect together the materials for preparing syrup (sugar, water, jug).
- Step 2:** Mix 1.5 kg sugar and 1.5 litres warm water in a jug and stir thoroughly to dissolve. Cool before using.
- Step 3:** Pour the prepared syrup into a frame feeder or plastic jar feeder.
- Step 4:** Discuss and share information on any issues not covered in the practical exercise.

Preparation of candy

- Step 1:** Collect together the materials for preparing candy (honey, powdered sugar, water, container for mixing). Grind the sugar if powdered sugar is not available.
- Step 2:** Mix 0.5 kg powdered sugar and 100 gm honey thoroughly in a cooking bowl or bucket. (You can use water if no honey is available, but it is not as nutritious.)
- Step 3:** Wrap the candy in wax paper or a plastic sheet keeping both ends open and place it on the top of the frame or on the bottom board in the hive, taking care not to squash any bees.
- Step 4:** Discuss and share information on any issues not covered during the practical exercise.

Pollen substitute

- Step 1:** Collect together the materials for preparing pollen substitute (soya flour, honey or powdered sugar, water)
- Step 2:** Mix 100 gm soya flour with honey, or powdered sugar and a little water, until it has a candy-like consistency.
- Step 3:** Place the substitute on top of the frame bar in the brood chamber taking care not to squash any bees.
- Step 4:** Discuss and share information on any issues not covered during the practical exercise.

Activity 3: Lecture

Give a presentation on the importance of comb foundation, how to prepare it, and how to use it, as outlined in the resource materials (below). Use slides and photos to illustrate the talk, or large blown up photos and diagrams in areas where there is no electricity.

Activity 4: Practical exercise

Trainees learn to use comb foundation and how to store comb foundation and old combs.

Using comb foundation

- Step 1:** Collect together the materials and equipment.
- Step 2:** Demonstrate how to put comb foundation in a frame by fitting the foundation in the groove.
- Step 3:** Fix the foundation in the frame with melted wax from a pot or burning candle
- Step 4:** Attach the wires of the frame to the face of the comb foundation with drops of melted wax or by pressing the wire into the comb foundation with a sharp heated knife or hive tool.
- Step 5:** Make sure that the comb foundation is properly fixed in the frame.
- Step 6:** Place the frame with comb foundation in the hive.

Storing comb foundation

- Step 1:** Place the sheets of comb foundation in a pile with a piece of paper the same size as the foundation between each sheet.
- Step 2:** Wrap the pile of comb foundation sheets with a larger piece of paper in a flat bundle and tie securely so it is fully closed and not open to the air.
- Step 3:** Store the packed comb foundation sheets in a safe dry place.

Methods for storing old combs are given in the resource materials.

Activity 5: Discussion and question and answer

Take home message

- An artificial diet is mainly provided in emergencies. When fed continuously, it should be fed for 3 days followed by a 3-day non-feeding interval.
- A colony may be destroyed as a result of robbing and natural pests such as ants if the artificial diet is provided without proper care.
- Beekeepers need to remove old combs every 2 years and should use comb foundation made of pure beeswax to ensure good quality honey production.
- Beekeepers need to use the appropriate size of comb foundation for the frame to reduce production of drones and minimize the chances of comb destruction during migration and honey extraction.

Session 14 Resource Materials

Artificial Diet and Comb Foundation and Management

Artificial Diet and Feeding Management

Nectar and pollen may not be available in sufficient quantities throughout the year in the bee pasture. Artificial food is needed to supplementing the colony's diet during times of food deficiency.

- Artificial feeding is needed to meet the daily energy requirements of a colony if the hive food store is exhausted.
- An artificial diet also activates bees to work.

Different types of artificial food can be used for feeding in different seasons and circumstances. An artificial diet is mainly provided in emergencies. When fed continuously, it should be fed for 3 days followed by a 3-day non-feeding interval. It is important to avoid spillage outside the hive as spilled food can attract pests such as ants that may destroy the colony. The three common types of food are sugar syrup, candy, and pollen substitute.

Sugar syrup

Preparation and use

Syrup is used in different concentrations. The amount and strength of syrup is selected according to the specific situation and season.

- 1:1 syrup (1 part sugar, 1 part water)
This is normally given as a supplement when there is a food deficiency in a normal colony or during the dearth season in order to activate the colony to work.
- 2:1 syrup (2 parts sugar, 1 part water)
This syrup is used to feed medicine and in the cold season.
- 1:2 syrup (1 part sugar, 2 parts water)
This syrup is used for feeding in the hot dry season.

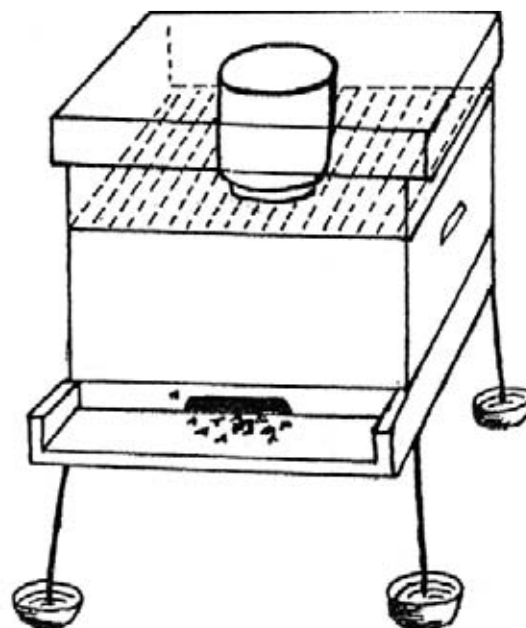
Feeding using a frame feeder

- Pour the syrup into a frame feeder, put 5–7 pieces of straw into the feeder extending to the upper edges to prevent the bees from sinking, and place the feeder in the hive
- The feeder can also be loosely covered with clean muslin before placing in the hive to facilitate feeding.

Feeding using a plastic jar

- Perforate the lid of a plastic jar with a series of holes.
- Pour the syrup into the jar, tightly close the perforated lid, and invert the jar on the lid of the inner cover or on top of the frame bar so that bees can feed from it (Figure 52).

Figure 52: Artificial feeding with an inverted plastic jar containing sugar solution



Precautions for feeding

- Always feed in the evening, except in special situations such as feeding a new swarm.
- Place the syrup inside the hive not outside.
- Remove the feeder with any remaining syrup in the morning.
- Do not spill the syrup when preparing it or feeding the colony.
- Wipe up any spilled syrup immediately with a wet cloth.
- Do not provide more syrup than needed.
- Feed the syrup on the same day it is prepared.

Candy

Candy is a semi-solid material prepared with finely ground sugar mixed with honey or water. It is used as a supplement during the dearth period. In general, candy prepared from 0.5–1 kg of sugar is enough to feed a colony for 1 day during the dearth. Honey or water can be mixed with the powdered sugar to produce candy, but candy prepared with honey will keep better and is more nutritious.

Preparation

- Grind the sugar to a fine powder on a clean slate or in a mill.
- Mix 200–300 g honey thoroughly with 1 kg powdered sugar. The amount of honey should be just sufficient to give a semi-solid 'candy' consistency. Water can be used instead of honey, but is not as good. Wrap candy in a plastic sheet with closely positioned holes punched in it, or a solid plastic sheet or wax paper with both ends open.

Feeding

- Place the candy on the top bars, in an open space in the brood chamber, or in a frame feeder placed in the middle of the brood chamber.

Pollen substitute

Pollen is a basic food for the overall development of honeybees. It is rich in protein which is needed for the physiological development of adults and brood. Ideally bees should be fed in the hive with stored pollen; if this isn't available, an artificial pollen substitute can be prepared.

Preparation

- Make flour from soya or gram by roasting, de-husking, and grinding.
- If used, grind sugar to a fine powder on a clean slate or in a mill.
- Mix 100 g of soya flour with enough honey, or powdered sugar and a little water, to make a candy like consistency. This amount is usually enough for 1 week for one colony.

Feeding

- Wrap in a clean perforated plastic bag and place on the top bar, being careful not to squash any bees. Leave in place until fully consumed. If made with sugar and water, check occasionally for signs of fungus growth and remove if necessary.

Comb Foundation and Management

Comb foundation is a sheet made of beeswax with an embossed comb pattern, which is used in modern beekeeping to help bees build regularly-shaped combs fast (see Figure 29 in Session 6). Worker bees consume a large amount of honey and nectar when producing wax to build combs (estimates suggest 10 g of honey to make 1 g of beeswax), and it takes a considerable amount of time. Thus comb building reduces the productivity of the colony. Comb foundation speeds up the process by providing a wax base and a pattern that bees can use to start from when building a new comb. It must be used in the brood chamber frames, and can also be used in frames for the super chamber if no old combs are available for

reuse. Different comb foundation is used for *Apis mellifera* and *Apis cerana* bees; foundation for the Newton hive (*Apis cerana*) has a smaller cell size and smaller sheets. Using comb foundation has a number of advantages.

- It helps production of straight regular combs.
- It is easier for beekeepers to inspect and replace combs.
- Honey can be harvested with a honey extractor (which requires straight combs) to give uncontaminated high quality honey; harvesting with an extractor is faster and doesn't break the combs so that they can be reused.
- Collection and storage of hive product is faster as the bees use the small volume of wax they excrete more efficiently.
- Combs are stronger and will not be damaged during migration.
- Drone production in a hive can be minimized as the foundation does not have the larger cells needed for drone rearing. When the bees want to rear drones, they adapt the foundation and make larger cells.

Installing comb foundation

- The foundation sheet should be placed in the groove of an empty frame, fixed with melted wax from a pot or burning candle, and the wires of the frame attached to the face of the comb with drops of melted wax or by pressing the wire into the comb foundation with a sharp heated knife or hive tool.
- Foundation is mainly used in the brood chamber and in or just before the honey flow season. If combs are needed in the super of a bee colony, it is best to use stored old combs, or to move honeycombs from the brood chamber to the super and place new comb foundation in the brood chamber.
- The frame with foundation can be placed at the centre or side of the hive according to the colony status and season. It should be placed at the side in a strong colony and at the centre in a weak colony. It is better not to provide foundation during the dearth season, but if needed, it should be placed at the side. In a strong colony, old combs or foundation should be added to the super shortly before the honey flow season. Two or more comb foundations can be supplied at the same time to a colony in the honey flow season.
- Comb foundation can be cut to fit the super chamber if needed.
- The colony size and external temperature should be taken into consideration when adding comb foundation.
- During the cold season, the comb foundation or stored old combs should be dipped in warm water before placing in the hive.

Storing comb foundation

New foundation

- Prepared comb foundation sheets should be wrapped in clean newspaper, with individual sheets separated by a piece of paper, and stored safely in a cool dry place for later use.

Old combs

- Wrap old drained combs still in the frame in newspaper. Store safely in a cool, dry place protected from fungi and insects. Make sure they are free from wax moth or other pests before reusing.
- After opening a packet of old combs, select ones that are reusable and air them in the open for 24 hours in a safe place.
- Immerse the combs in clean water for a short time, drain the water from the cells on both sides, dry in the shade, and then use.

