Rearing of Bees

Artificial Bee rearing (Apiary), Beehives – Newton and Langstroth box

Bee Pasturage

Selection of Bee Species for Apiculture

Modern Bee Keeping Equipment

Methods of Extraction of Honey (Indigenous and Modern)

BENEFITS OF BEEKEEPING

Beekeeping is the secondary source of income. Because of the following reasons you may adopt it:

(i) **Production of bee hive products:** Honey bees are the sole source of honey and beeswax. The bee hive products namely honey, pollen or bee bread, royal jelly, bee propolis, bee venom and beeswax can be produced by bee keeper after adoption of beekeeping for generation of income and self employment among rural masses of the country.

(ii) **Utilization and harvesting of nectar and pollen of highly nectariferous plants:**

About 30 – 50 kg honey can be produced and harvested by one hectare highly nectariferous crop plants occupied area such as lahi (*Brassica campestris* var. t*oria*), mustard, litchi, pigeon pea, sunflower, eucalyptus, anola, ber, jamun, drumstick, karanj, junglejalibi, mahua, shisam, siris, semal, palas, cucurbits, coriander etc.

The natural floral reward i.e. nectar and pollen may be utilized for production of bee hive products as food source otherwise these produce may be wasted in nature.

(iii) **Enhancement of yield through bee pollination:** If you are associated with growing crops in your field, beekeeping may give you dual benefit by enhancing crop production. The transference of pollen during floral visit is performed by worker bees and consequently stigma of flowers is pollinated by highly suitable highly feasible and acceptable pollen grains. Services of bees resulted in enhancement of yield and improvement of seed quality. About 20-25% yield is increased by bee pollination as compared to the natural pollination of the various crops.

(iv) **Apitherapy for cure of diseases:** Bee hive products are used as medicinal agent. These materials such as honey, royal jelly, propolis and bee venom can cure more than 50 human diseases. Few are mentioned below -

(a) **Honey** : The honey consists of antimicrobial substances. It is useful for respiratory infection and is beneficial against heart diseases. It is also a rapid source of energy.

(b) **Royal Jelly** : This bee hive product is anti- tumourous, antimicrobial and most nutritious substance, secreted by the young worker bees for feeding of queen and queen larva. It is used for the treatment of high blood pressure, arthritis and joint pain.

(c) **Propolis** : It is beneficial for the treatment of skin diseases as antimicrobial agent, skin burns, joint pain, throat and dental diseases.

(d) **Bee venom** : This is the poison that makes bee stings painful. Bee venom is used to make medicine for curing muscular diseases, arthritis and gout.

(v) **Generation of income and self employment as natural agro-based cottage industry:** The potential of generation of income per colony per year is about Rs. 3000 – 4000 annually through honey production and multiplication of bee colony. Only two trained man power is required for management of apiary of hundred bee colonies.

(vi) Beekeeping does not require farm land. Farmers with small land holding or even landless can adopt this and become self reliant.

(vii) It does not require heavy physical work. Even women and children can adopt it.

(viii) It encourages rural artisans to undertake the job of manufacturing equipments required for beekeeping.

(ix) It does not require heavy investment. Inputs are very low as raw material for production of honey is obtained free from nature so output to input ratio is very high.

(x) It provides proportionately more and immediate return than any other agro based profession.

(xi) Beekeeping is a clean and hygienic profession, as it does not require daily feeding or cleaning of litter.

(xii) Beekeeping business contributes significantly to national economy.

HONEYBEE PRODUCTS

Certainly you might have tasted delicious honey many times. But, do you know there are other bee products also which has many health benefits? Let us know about them:

(i) Honey: Honey is the natural sweet substance produced by honey bees from the nectar of blossoms, which honey bees collect, transform and combine with specific substances of their own, store and leave in the honey comb to ripen and mature. Bees normally take about 3-4 weeks for storing, ripening and sealing of honey in comb cells. The colour of honey varies from nearly colourless to dark brown. It also indicates quality, because honey becomes darker during storage or if it is heated.

Honey contains a good amount of digestible sugar, minerals, vitamins, enzymes, water, etc. The aroma, taste and colour of honey are determined by the plants from which the bees have gathered nectar. For example, nectar collected from sunflowers give a golden yellow honey. Honey absorbs moisture very quickly and should be kept in air tight containers.

Table 2.2 : COMPOSITION OF HONEY

Nutrient	Percentage
Water	13-20
Fructose	40-50
Glucose	2-3
Sucrose	1-2
Maltose	7-8
Acids	0.5
Proteins	0.25
Minerals	Traces
Enzymes & Vitamins	2-3 (B1, B2, C)

(ii) **Pollen:** When bees visit flowers, pollen sticks to the fine feather-like hair whichcovers the body. Bees remove the pollen from the hairs using the pollen comb; a structure on the hind legs. Then she forms the pollen into small pellets with the pollen press, and sticks it into the pollen basket to carry it back to the hive. Pollen is stored in cells immediately surrounding the brood nest where it is readily available for feeding brood and for consumption by the nurse bees.

(iii) **Beeswax:** It is a complex mixture of organic compounds secreted by four pairs of special glands on the worker bee's abdomen. It is used for building wax comb. Beeswax can be secreted only at relatively high temperatures and after a large intake of honey or nectar. It is produced by 12 to 18 days old honey bees. A bee converts 15kg of honey into 1 kg of wax. It is used in medicine, confectionery items cosmetics and polish.

(iv) **Royal Jelly:** Royal jelly is the food produced by the young worker bees through glandular secretion. It is given to freshly hatched larvae. Royal jelly has many different components including proteins, sugars, fats minerals and vitamins. It contains many insect growth hormones and is valued as a medicine or tonic in various parts of the world. It reduces the aging process in human beings. The beekeepers remove the larvae and harvest the royal jelly for marketing. Royal jelly deteriorates quickly after harvest and must be kept frozen or freeze-dried during handling, storage, transport and marketing.

(v) **Propolis**: It is a gummy reddish brown substance gathered by the bees from resinous substance found on trees and buds of plants. It is also called 'bee glue' and is used to close small crevices in the hive. It is very sticky in warm weather and brittle in cold weather. Bees use propolis as building materials to decrease the size of nest entrances and to make the surface smooth for passing bee traffic and to varnish inside brood cells before a queen lays eggs in them, providing a strong, waterproof and hygienic unit for developing larvae. It is used as an antibiotic and helps in curing the crack feet in human beings. It is used as an ingredient in toothpaste, soaps and ointments.

(vi) **Bee Venom:** It is present in the sting of honeybee and having medicinal value. Bee venom is clear, odourless, watery liquid having somewhat sharp and bitter taste and hydrolytic blend of proteins with basic pH. It is produced by venom glands associated with the sting apparatus of worker bees and used as a defensive agent against enemies specially predators. The worker bee injects the venom into the victim while stinging. A single worker has about 0.5 mg venom.

Artificial Bee rearing (Apiary), Beehives – Newton and Langstroth box

A beehive is a rectangular wooden box filled with moveable wood or plastic frames, each of which holds a sheet of wax or plastic foundation. The bees build cells upon the sheets of foundation to create a complete honeycomb. Foundation comes in two cell sizes:

(i) worker foundation, which enables the bees to create small, hexagonal worker cells and

(ii) drone foundation, which allows the bees to build much larger cells for drones.

The bottom box, known as brood chamber contains the queen and most of the bees and the upper boxes or supers contain just honey. The young nurse bees produce wax flakes to build honeycomb using the artificial wax foundation as a starting point, after which they may raise brood or deposit honey and pollen in the cells of the comb. You may choose a beehive depending upon the bee species, cost, ease of production and expected returns.

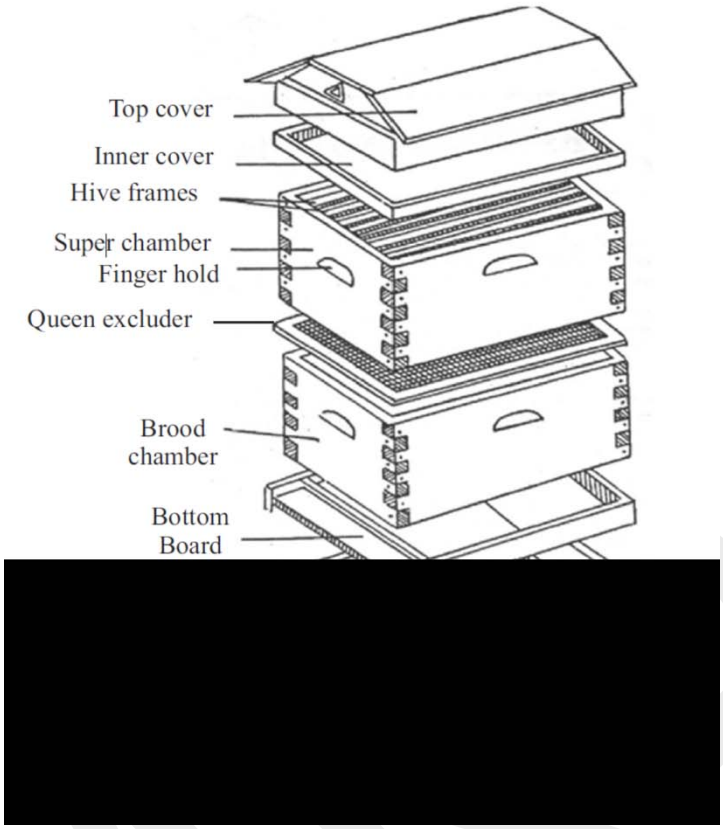
Different types of bee hives were in use in various parts of our country. They are pot hive, nucleous hive, single walled and double walled Dadant hives, British standard hive, Langstroth hive, Indian Standard Industries (ISI) hive, Jeolikote hive and Newton hive.

Of all these types, Langstroth hives for rearing Italian bee and Newton's hives for rearing Indian bees are most popular. Beehives may be divided into three types:

 Fixed comb hives: These are traditional hive, which include structure made of cylindrical bark and log hives and various other hives of many different forms and materials.

 Movable-comb hives: These are the top- bar hives, where bees build their comb attached to a top bar that can be lifted out of the hive. They have no frames.

 Movable-frame hives: A modern beehive is known as the movable frame hive. These hives have movable frames which hold the wax sheets that serve as a starting point for the bees to build honeycomb. The top wooden box consists of honey while the bottom box consists of queen bee and the other worker bees. A beehive is selected keeping in view the race of bee to be reared. A standard movable frame hive (Fig 3.1) has the following major parts:



1. **Bottom/floor board**: It forms the floor of the hive made up of a single piece of wood or two pieces of wood joined together. There is a removable entrance rod in the front side with two entrance slits to alter the size of the hive entrance based on need. A two inch wide extended part of the bottom board beyond and in front of the hive entrance is known as ‘alighting board’ for returning bees to alight on it before passing into the hive through entrance. Bees also take off flight from this board. Most of their movement and observation without opening the hive can be observed at the alighting board.

2. **Brood Chamber:** It is rectangular box with 8 to 10 hanging wooden frames. Frames inside the brood chamber are called brood frames. The comb cells are used for food storage, clustering, raising baby bees, and air conditioning. The queen or egg laying workers lay eggs inside this chamber. Thus, a brood chamber is like a ‘nursery’ where the queen lays her eggs and where the colony stores its food. It contains young stages of honeybee (young larva and pupa) and food for them. The daily requirement of honey and pollen is stored in this chamber

3. **Super Chamber:** It is kept over the brood chamber and its construction is similar to that of brood chamber. The frames inside this chamber are called super chambers. The length and width

of this chamber is similar to that of brood chamber. The height may be also similar if it is full depth super as in Langstroth hive. But the height will be only half if it in a Newton's hive.
Surplus honey is stored in super chamber.

4. **Queen excluder:** Brood chamber and super chamber may be separated by a perforated sheet 'queen excluder' to restrict the movement of egg laying queen bee going into the honey super. This is a metal sheet with regular openings of the specified size, framed with wooden border. The size of opening is such that the worker can move through easily but the queen does not pass through it. The queen bee is, thus, restricted into the lower 'brood chamber' so that the honey is not contaminated.

5. **Hive Cover:** It insulates the interior of the hive. In Newton's hive it has sloping planks on either side. On the inner ceiling plank there is a square ventilation hole fitted with a wire gauze. Two holes present in the front and rear also help in air circulation. In Langstroth hive, the hive cover consists of a crown board or inner cover and an outer cover (top cover). The inner cover is provided with a central ventilation hole covered with wire gauze. The outer cover is covered over with a metallic sheet to make it impervious to rain water. Circular ventilation holes covered by wire gauze help in air circulation. It protects the hive against rain and sun.

6. **Frames:** The frames are so constructed that a series of them may be placed in a vertical position in the brood chamber or the super chamber so as to leave space in between them for bees to move. Each frame consists of a top bar, two side bars and a bottom bar nailed together. Both the ends of the top-bar protrude so that the frame can rest on the rabbet. The depth of the super frame is less than that of the brood frame in Newton's hive and India Standard Industries (ISI) hive. But in Langstroth hive it is same as that of brood frame.

Hive bodies painted externally will last longer. The colour of the paint should be white, blue, yellow or green. White is generally preferred for hive construction. It offers durability, flexibility, easy handling and improves the colony efficiency in regulating hive interior temperature and humidity.

Bee hives are constructed mainly with seasonal timber such as teak, kail or toon. The timber should be free from insect holes, dead knots, shakes, splits and cracks. The thickness of the wooden walls should be 20 mm.

Advantages of Rearing Bees in Modern Beehives

The advantages of rearing bees in modern beehives are as follows:

1. Provides sufficient space for free movement of bees.

2. Provide ample space for increasing number of workers through addition of supers.

3. Facilitates in regular and easy inspection of colonies.

4. Facilitates the bees to construct standard sized combs.

5. Pure honey can be extracted without damaging the combs.

6. Facilitates easy transportation of colonies from place to place whenever and wherever required.

7. It helps in increasing the productivity of honey and other bee products.

SPECIFICATIONS OF BEEHIVES

Langstroth hives for rearing Italian bee and Newton's hives for rearing Indian bees are most popular. The specifications of both the hives are given below:

Langstroth ten-frame hive

1. **Bottom board (floor board):** Bottom part of the hive length 22" long 16.25" broad and 7/8" thick. Another wooden rod 14.5" be nailed at the back and the front be provided with similar rod (entrance rod but having an entrance in the middle) after leaving 2" space so that these nailed rods make a rectangle of 2" x 16.5" .

2. **Alighting board:** The 2" space in front of the entrance rod meant for the bees to take off flight or land on it.

3. **Entrance**: In the middle of the entrance rod is given a cut 3" long and 3/8" deep as a passage for bees to enter or leave the hive.

4. **Brood Chamber:** Is a box, made of wooden planks, without bottom and is placed over the bottom board. It is 20" in length 16.25" in width and 9.5" in height and 0.875" thick. A robbat 0.625"of deep and 0.5" wide is cut along the upper inner length of its width planks. The internal dimensions of the chamber are 18.25" x 14.25".

5. **Frames**: Each chamber contains 10 frames and a dummy board. A frame has four wooden pieces – Top bar, bottom bar and two side bars.

(i) **Top bar**: 19" length x 1" width x 7/8" thickness. A groove is present on lower side of top bar to insert comb foundation sheet.

(ii) **Side bar:** 9.125" length x 1.125" (upper half) and 1" (lower half) width 3/8" thickness. There are four holes in each of the side bar for wiring the frame.

(iii) **Bottom bar:** 17.625" length x 0.75" width x 0.375" thickness.

6. **Dummy board:** Just a wooden plank of the frame size Length 19” at the top and 17.625” at the bottom x 9.125” width 0.375”and thickness.

7. **Super Chamber/honey chamber with bee frames:** Same as the brood chamber.

8. **Inner cover**: Wooden plank 20” long x 16.25” wide and 0.375”. Inner cover is nailed 0.375” thick, 0.875” wide wooden rod on its four sides. In the centre of the plank a suitable cut (about 2 x 3”) is given which is provided with a wire screen for ventilation.

9. **Top/Upper cover**: It is the top most cover 21” long, 17” wide and 0.375” thick. This plank is provided with a frame, 2” wide 0.875” thick, its top side is covered by G.I/Aluminum sheet. Inner side of the outer cover is provided with four small wooden pieces to the inner cover so that the ventilation is not blocked.

Newton’s bee hive

1. **Floor board:** 14” x 9.5” in size with an extension in front which serves as an alighting board.

2. **Brood chamber:** 9.75’’ x 8.25” x 6.75” in size with an entrance slit of 3.5” x 3/8”
at the base; it is mounted over the floor board.

3. **Wooden frames:** Eight separate wooden frames 8.75” x 5.75” x 6” in size and 7/8” broad: they are hung inside the brood chamber

4. **Super chamber:** 9.75” x 8.25” x 3.125” in size: it is kept over the brood chamber.

5. **Top cover:** It is board having same dimensions of brood or super chamber. In the centre there is an opening covered with wire gauge. It is kept on super or brood chamber.

OTHER BEEKEEPING EQUIPMENTS

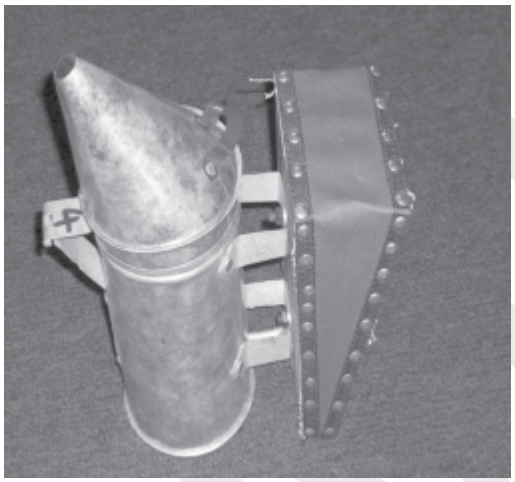
Besides the hives, you will need other equipment and tools like the hive stand, nucleus box and smoker to run your business smoothly. You will also need various equipments and machinery for handling and processing of honey, beeswax, for manufacture of comb foundation sheets, and for other operations. Few are described as below:

1. **Hive stand:** A four legged wooden, metal pipe or angle iron, rectangular support to the hive. It helps to protect the bottom board from rot and cold transfer.

2. **Smoker:** The smoker is used to protect beekeepers from bee stings and to control the bees. Smoke is the beekeeper’s third line of defence. You may use “smoker”– a device designed to generate smoke from the incomplete combustion of various fuels to calm down the bees. Smoke

initiates a feeding response in anticipation of possible hive abandonment due to fire. Smoke also masks alarm pheromones released by guard bees or when bees are squashed in an inspection. The ensuing confusion creates an opportunity for the beekeeper to open the hive and work without triggering a defensive reaction.

You may use hessian, twine, burlap, pine needles, corrugated card board, and mostly rotten or punky wood as a fuel to make a smoker. However, Indian beekeepers, often use coconut fibres as fuel for smoker as they are readily available, safe, and of negligible expense. Some beekeeping supplying sources also sell commercial fuels like pulped paper and compressed cotton, or even aerosol cans of smoke. Other beekeepers use sumac as fuel because it ejects lots of smoke and doesn't have an odour. Some beekeepers are using "liquid smoke" as a safer, more convenient alternative. It is a water-based solution that is sprayed onto the bees from a plastic spray bottle.



3. **Protective Clothing:** To protect beekeepers eyes and nose from stings at the time of work near the apiary, proper cloths are required. As novice beekeepers you should always wear gloves and a hooded suit or hat and veil. The face and neck are the most important areas to protect, hence you should wear atleast a veil. Defensive bees are attracted to the breath, and a sting on the face can lead to much more pain and swelling than a sting elsewhere, while a sting on a bare hand can usually be quickly removed by fingernail scrape to reduce the amount of venom injected. The protective clothing is generally light coloured and of a smooth material. This provides the maximum differentiation from the colony's natural predators. 'Stings' retained in clothing fabric continue to pump out an alarm pheromone that attracts aggressive action and

further stinging attacks. Washing suits regularly and rinsing gloved hands in vinegar minimizes attraction. The important clothing and accessories are as follows:

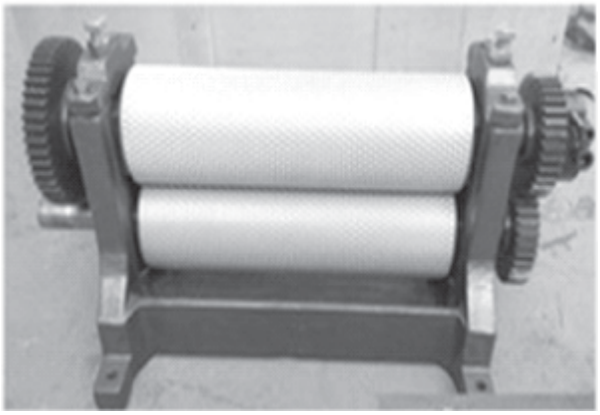
(i) **Bee veil:** It is a cap made of cloth and wire or fabric net. It is worn over face for protection against stings. It should be made up of black nylon netting screen (12-mesh). Veils should be made to fit snugly around the hat and to fit tightly to the shoulder leaving enough space between veil and face.

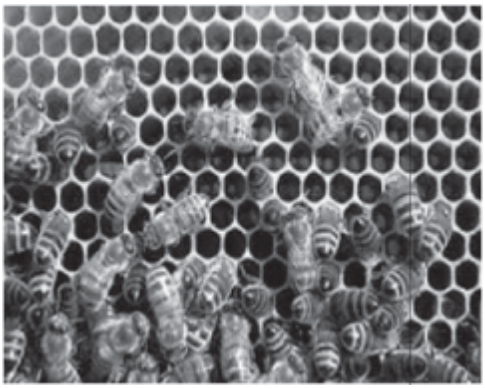
(ii) **Overalls:** Also known a bee suit, is a protecting garment worn loosely over the clothes so that the bees cannot get under the clothes. Light coloured cotton materials are preferable since they are cooler and create less risk for antagonizing bees. It should be worn bee-tight so that the bees are not able to enter from the sleeves.

(iii) **Gloves:** Bee gloves are made of tightly-knit cloth (or) soft leather. They cover the fore arms. The gloves are useful for the beginners to develop confidence in handling bees. But handlings of frames will be cumbersome if gloves are worn.

(iv) **High boots:** A pair of gum boots will protect the ankles and prevent bees from climbing up under trousers.

4. **Comb foundation sheet –** is made up of wax. It is artificially provided for the colonies during honey flow season by cutting them to a proper conical size and attaching them to super frames by means of thread or fibre. It is a thin sheet of beewax embossed with a pattern of hexagons of size equal to the base of natural brood cells on both sides. The size of the hexagon varies with bee species. The sheet is fixed to the frames on fine wires threaded through holes in the side bars and stretched tight. A spur or an electrical heating device is used to embed wires into the comb foundation sheets which are prepared in a comb foundation mill. The bees construct superstructure of comb cells over the sheet.





5. **Dummy division board/Movable wall:** It is a wooden board slightly larger than the brood frame. It is placed inside the brood chamber. It prevents the bees from going beyond it. It can be

used as a movable wall thereby limiting the volume of brood chamber which will help the bees to maintain the hive temperature and to protect them from enemies. It is useful in managing small colonies.

6. **Porter bee escape board or super clearer:** It is a device which allows the bees to go through a self closing exit. A board having one way passage in the centre can also is used. It is kept in between honey super chamber and brood chamber. It is used for clearing the bees from super chamber for extracting honey.

7. **Drone excluder or drone trap:** It is a rectangular box with one side open. Theother side is fitted with queen excluder sheet. At the bottom of the box there is a space for movement of worker bees. There are two hollow cones at the bottom wall of the box. Drones entering through the cones into the box get trapped. The narrowend of the cone is wide enough to let the bees pass out but not large enough to attract their attention or re-entry. This device is used at the entrance to reduce the drone population inside the hive.

8. **Swarm trap:** It is a rectangular box used to trap and carry the swarm. It is fixed near the hive entrance with one (or) two combs inside during the swarming period. This box traps and retains the queen only. But the swarm coming out from the hive re-enter the hive and settles on the comb, since the queen is trapped. Thus the swarm is induced to settle in the frame, which can now be transferred to a hive at a desired place.

9. **Pollen trap:** Pollen trapping screen inside this trap scrapes pellets from the legs of thereturning foragers. It is set at the hive entrance. The collected pollen pellets fall into a drawer type of receiving tray.

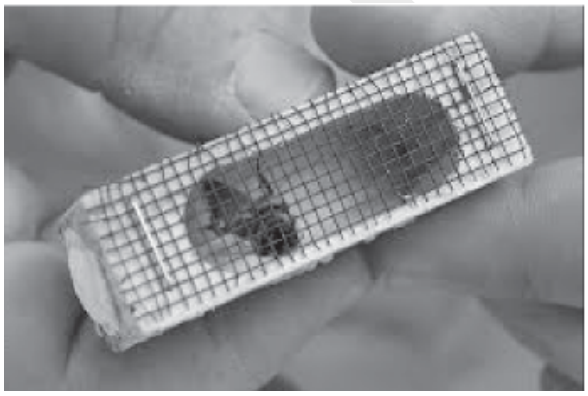
10. **Division Board / Sugar Feeder:** It can be hung along with the frames. A wooden strip or cut bits of leaves kept inside serve as float which prevents the drowning of bees in the sugar syrup.

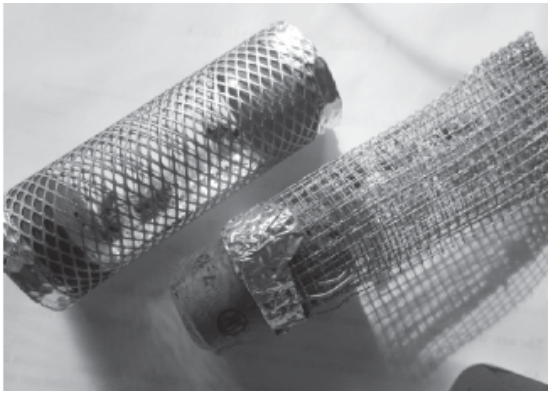
11. **Hive tool:** It is a piece of flattened iron with flattened down edge at one end. It is useful to separate hive parts and frames glued together with propolis. It is also useful in scrapping excess propolis or wax and superfluous combs or wax from various parts of the hive.

12. **Queen excluder:** It is made up of perforated zinc sheet. The slots are large enough to allow the workers to pass through but too narrow for the queen. A wire grid/ dividing grid with parallel wire mounts can also be used as a queen excluder. It is inserted in between the brood frames in single storey hive. It is useful to confine the queen to brood chamber. But it allows the workers to have access to super. It prevents the queen from laying eggs in honey combs. It is also used in producing royal jelly in queen rearing and in forming multi-queen colonies.

13. **Queen Gate:** It is a piece of queen excluder sheet. It is fitted on the slot of entrance gate. It confines the queen inside the hive. It is useful to prevent swarming and absconding. It also prevents the entry of bee enemies like wasps into the hive.

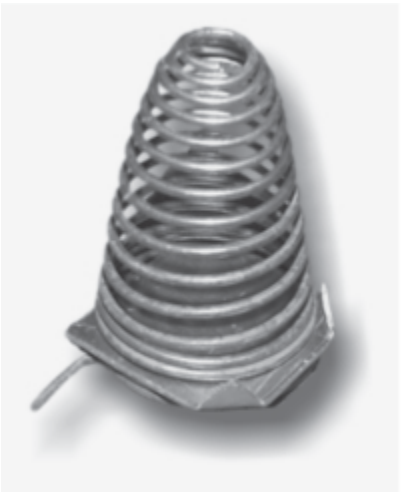
14. **Queen Cage:** It is a cage made up of wire gauze. It is useful for queen introduction.





15. **Queen Cell Protector:** It is a cone shaped structure made of a piece of wire wound

spirally. It fits around a queen cell. It is used to protect the queen cell, given from a queen right to a queenless colony until its acceptance by bees.



16. **Bee brush:** A soft-camel-hair brush is used to brush the bees off the honeycomb before it is taken for extraction.

17. **Decapping knife:** Single (or) double edged steel knife is used for removing wax cappings from the honey comb.

18. **Honey extractor:** This equipment consists of cylindrical drum containing a rack or box inside to hold the super frames. The box is fixed to a rod at the centre and it can be rotated by a set of two gear wheels. The frames with honey cells are decapped by a sharp knife after dipping it in hot water and fixed to the slots provided in the box which is rotated by the handle. The rotation should be very gentle and slow at first and the speed of revolution increased gradually. With some experience the correct speed can be learnt. The honey in the cells is forced out in droplets by the action of the centrifugal force and can be collected in vessels through an exit in the drum. As cells are constructed on both sides of the comb, by changing the sides of the frames

and again rotating, the honey contained in the cells on the other side can also be drained off. Particular care should be taken while handling heavy combs or those which are flimsily attached to the frames.

19. **Embedder:** It is a device just like screw-driver to embed the frame wires in the comb foundation sheets.

20. **Drip Tray:** It is a tray made up of stainless steel or zinc coated iron used to collect the droppings of honey and wax cappings while uncapping the sealed combs of honey.

21. **Feeders:** Used to feed sugar syrup to honeybees during dearth period.

STARTING A COLONY

Selection of Bee Species for Apiculture

Six species of bees of commercial importance are found in India; *Apis dorsata* (Rock bee), the Himalayan species, *Apis laboriosa*), *Apis cerana indica* (Indian hive bee), *Apis florea* (dwarf bee), *Apis mellifera* (European or Italian bee), and *Tetragonula iridipennis* (Dammer or stingless bee). Rock bees are aggressive and cannot be maintained but are harvested from the wild. Honey from dwarf bees is also harvested from the wild as these are nomadic and produce very small yields. Native *Apis cerana* and *Apis mellifera* introduced from the temperate zone are more amenable to culturing in artificial bee boxes. Dammer bees can be domesticated and are important factors in pollination of various crops but produce little honey.

Average honey yield per year per hive

Bee	Yield
Apis dorsata	36 kilograms (79 lb)
Apis cerana indica	6 kilograms (13 lb) to 8 kilograms

Average honey yield per year per hive	
Bee	**Yield**
	(18 lb)
Apis florea	500 grams (18 oz)
Apis mellifera	25 kilograms (55 lb) to 40 kilograms (88 lb)
Dammer bees	100 grams (3.5 oz)

Establishing colonies

As a beginner, you may start beekeeping by purchasing established colonies from a local beekeeper or the State Department of Agriculture/ State Agricultural University/ Research Institution/ Khadi & Village Industries Board. Normally a bee colony with 5 frames full of bees having sealed brood and immature brood, especially with eggs and young queen should be used to start hiving. Following tips may be useful to you:

1. Make preparations: Before setting up an apiary, you should be ready after undergoing proper training, buying new equipments, assembling new hives with the help of an expert, ordering new colonies well in advance, etc.

2. Start small: Two or four colonies are ideal number for a beginner to keep for one or two year. Expand the colonies as you gain experience.

3. Execute work: When the package of bees arrives, your hives should be on the site. Prepare a work schedule and follow strictly. Suitable season for starting beekeeping coincides with mild

climatic conditions and availability of bee flora in plenty. Normally, spring (February-April) and post-monsoon
(September -November) seasons are the best periods to start beekeeping.

ESTABLISHMENT OF A BEEHIVE

A new beehive may be established by following ways:

- Capturing a swarm of bees
- Purchase a packaged bee colony
- Using of nucelus

1 Capturing a Swarm of Bees

To establish a bee colony, bees can be obtained by transferring a wild nesting colony to a hive or attract a passing swarm of bees to occupy it. Collecting honey bee swarms in the spring is an excellent way to replace winter losses, strengthen weak colonies, or start newones. Swarms normally cluster on a tree limb shrub, fence post, or on the side of a building. Swarms near the ground are relatively easy to capture. When possible, remove the swarm gently, disturbing the cluster as little as possible, and put it directly into a hive or enclosed container to transport it to a new hive or location. Before putting a swarm or even a colony in a prepared hive, it would be beneficial to make the hive smell familiar by rubbing old brown comb pieces or some bee wax. If possible, the Queen bee can be captured from a natural swarm and placed under a hive to attract the other bees. Feed the hived swarm for a few weeks with sugar syrup for its easy establishment.

2 Purchase a Packaged Bee Colony

The easiest and the best way to start beekeeping is by purchasing a packaged bee colony from an established beekeeper or a reputed supplier. A package consists of about 3000- 4000 bees. It has a cage with a young mated queen and two or three worker bees to care for her. The cage contains sugar candy as a food source. A cage containing sugar syrup is positioned in the middle of the package for feeding the bees during transportation. The package bees may not produce a honey crop in the first year. The bees will have to be fed until the start of the nector flow.

3 Using Nucleus

A nucleus, popularly known as “nuc”, is a hive of bees comprising two to five frames of comb instead of the standard 10 frame in a standard hive and smaller in size. A nucleus usually consists

of brood, honey and pollen, a laying queen, and each frame has adult bees. Get them inspected for any disease or pest by an expert. If the nucleus colony is strong then there is a possibility of getting a honey crop in the first year itself.

- Due care should be taken while selecting a site to place a beehive.
- A bee colony with 5 frames full of bees having sealed brood and immature brood, especially with eggs and young queen should be used to start hiving.
- Spring (February-April) and post-monsoon (September -November) seasons are the best periods to start beekeeping.
- A beehive may be established by capturing a swarm of bees, purchasing a packaged bee colony or using nucleus.
- To establish a bee colony, bees can be obtained by transferring a wild nesting colony to a hive or attract a passing swarm of bees to occupy it.
- The easiest and the best way for you to start beekeeping is by a purchasing a packaged bee colony from an established beekeeper or a reputed supplier.
- A colony can be divided when it has a large population of bees, brood and appears overcrowded.
- Colony is divided to increase the number of producing hives, to reduce the size of colonies, to discourage swarming, to control mites and to gain income from sale of nucleus colonies.
- Inspection of the brood frames is required to select a healthy bee colony.

Honey and beeswax extraction

Traditional methods

The traditional methods of extracting honey and beeswax are unsuitable and unhygienic. Extraction of honey by squeezing with the hand seems to be the quickest method for the average honey-tapper, who cannot afford a centrifugal honey extractor or solar wax-melter. However, the hand contaminates the honey, and unripe honey ferments within a few days after extraction. (Fermentation of honey is more a problem in coastal areas than inland.) Neem and coconut honeys are light in consistency and ferment more quickly than honeys produced from other plants.

The combs, including brood, unripe and capped honeycombs, are collected at night. They are all stacked on a wire mesh and a container is put underneath the pile of combs. Live embers are placed on the pile. The fire begins to consume the combs, and honey and wax trickle down into

the container until all combs are completely consumed by the fire. The material collected is left untouched until the next morning. The beeswax which has hardened at the top of the honey is removed, and the honey is poured into bottles of about one kilogram.

The disadvantage here is that honey loses nutritional value and quality when exposed to high temperatures. In addition, the smoky fire employed is full of ashes, charcoal, dust and gravel which contaminate the honey. Such honey tastes bitter and smoky. The brood combs also add water to the honey, and such honey cannot be stored for long nor enter international markets.

The solar vex-melter

This is a simple device and can be made by local craftsmen. The melter is made of wood, lined with a galvanized metal plate and has a glass or clear plastic cover. The base is airtight. The melter can be painted black to absorb more heat.

On a sunny day, the wax extractor is capable of generating a temperature of 61°C, enough to melt down a bee comb so that both honey and beeswax flow into a container inside the box.

A solar wax melter is a glass-covered box that uses the heat of the sun to melt beeswax and to separate it from honey and other materials with which it is found in honey bee colonies. The melter can be used to render old combs, cappings, burr combs and other hive scrapings containing wax. It is also handy for removing beeswax from excluders. The melter produces wax of high quality and eliminates the need for the sometimes hazardous job of rendering wax in the home.

The sloping top surface of the solar wax melter provides maximum exposure to the sun and allows honey and melted wax to drain quickly into the storage pan. Before use, the entire unit, including the sheet metal pan, should be painted black for maximum heat absorption. The glass cover with two sheets of double-strength glass about 1/4 inch apart helps to retain the absorbed heat. The fiberboard insulation also serves the same purpose. Internal temperatures, well above the melting point of beeswax (about 145° F, [63° C]), are maintained on warm sunny days. Place the melter in a sunny, sheltered spot for best results.

Hot bath method

In the absence of a wax-melter, the hot-water bath process now in use by some African beekeepers may be adopted. This is the quickest method of obtaining the wax, but it can only be employed after the combs have been crushed and the honey removed.

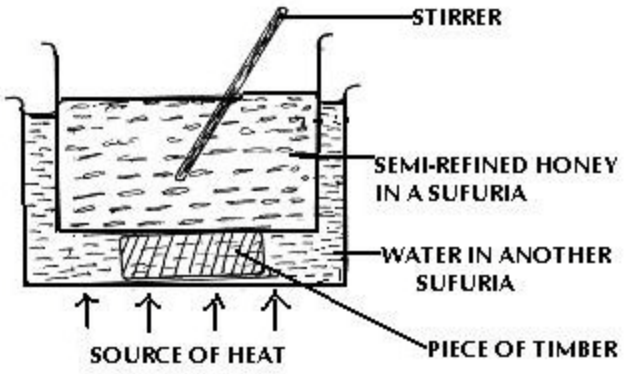
Equipment:

- a cooking pot
- sack cloth or a sack (preferably jute)
- string or twine (2-3 metres)
- a stick or a discarded top-bar
- a large spoon or ladle
- a mould for the wax

Procedure:

1. Put water (amount depending on the quantity of bee combs) into the cooking pot and heat over a fire.
2. Wash crushed bee combs to remove dirt and honey and place in the sack.
3. Make a good package by tightening the string around the sack.
4. By now the water should be quite warm. Put the package into the pot and use the stick to push it down to the bottom.
5. When it reaches a temperature of about 59°C, the wax begins to melt and a waxy scum begins to form on top of the water.
6. Use the stick to press the package. More wax will float to the top of the Water.
7. Use the ladle to skim off the melted wax and pour it into a mould. Continue this process until wax no longer rises to the surface.

Note: Do not subject beeswax to high temperatures. Prevent the water from boiling by reducing heat.



WATER BATH METHOD

Extraction of honey and beeswax by Ocloo's method

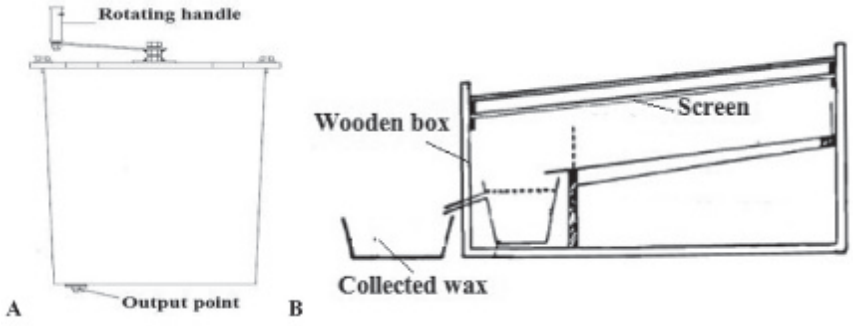
This method, suggested by a beekeeper from Accra, Ghana, is published here for its simplicity, cheapness and efficiency. The method works on the same principle as the solar wax melter, employing the sun's heat to melt down the combs.

Equipment

- a large container
- a sheet of nylon mosquito mesh
- a strong nylon cord and a needle
- a plastic or polyethylene cover

Procedure:

1. Fasten the mosquito mesh over the container with the nylon cord.
2. Place honeycombs on the wire mesh so that honey can trickle into the container.
3. Cover the honeycombs and container with plastic and secure it fast to the container with another cord.
4. Leave the honey and container in the sun. Both honey and wax will seep down into the container. The vex will harden above the honey and can be removed when the money cools down to be decanted and bottled.



Equipments used for collecting honeybee's products: (A) honey extractor, and (B) solar wax melter.

Moulding beeswax

Beeswax collected should be moulded in the following manner:

1. Use a container with a rounded bottom and a mouth wider than the bottom with a very smooth inner surface. Many plastic containers are suitable.
2. Place a small quantity of water (about a tablespoonful) in a cooking pot and put on the fire. Do not melt beeswax in a dry container. It should not be exposed to fire because it burns easily and can be damaged by too much heat. Melt beeswax and all bee combs outdoors.
3. Add all the beeswax and watch carefully as wax melts down. Remove it from the fire immediately after the last lump of wax has melted.
4. Pour melted beeswax into the mould and place in a cool, dry place to cool.
5. Remove the cakes of beeswax next morning.
6. The dark material collected at the bottom can be removed with a knife and can be sold to a shoemaker. The clean raw beeswax is ready for the market.

TERMS TO KNOW

Absconding swarm – Absconding swarm is an entire colony of bees that abandons the hive because of disease, wax moth, excessive heat or water, lack of resources, or other reasons.

After swarm/ Secondary swarm – After swarm is a small swarm which may leave hive after the first or primary swarm has departed. These after swarms usually have fewer bees associated with them than the primary swarm.

Apiary – The location and total number of hives at one place.

Bacteria – Bacteria are individual distinct cells which posses cell walls. They lack the true nucleus.

Bee Bread – Bee Bread is the food made from honey and pollen that worker bees make and feed to the uncapped worker and drone larvae.

Bee Brush – Bee Brush is a brush or whisk broom used to gently remove bees from combs.

Bee Veil – Bee Veil is a cloth or form of hat usually made of wire netting to protect the beekeeper's head and neck from stings.

Bee venom – Bee venom is the poisonous liquid secreted by bees when it stings.

Beehive – Beehive is a box with movable frames, used for housing a colony of bees.

Beekeeper – Beekeeper is a person who keeps and takes care of bees commercial (e.g., honey and wax production) or agricultural purpose (e.g. pollination of flowers)

Beekeeping of Apiculture – Beekeeping of Apiculture is an art and science of rearing and managing bees in a box called 'bee hive' for production of honey and other products like bee wax, propolis, and bee venom.

Beeswax – Beeswax is a wax produced by honey bees by special glands on the underside of the abdomen. It is used to build comb, where honey and pollen are stored.

Bee Space – Bee space was discovered by L. L. Langstroth as the optimum distance to be left in between two adjacent comb surfaces in a bee hive which is essential for normal movement and functioning of bees. It varies with honeybee species eg. for Indian bees: 7-8 mm and Italian bees: 8-9 mm.

Brood – Immature stages of bees not yet emerged from their cells; the stages are egg, larvae, pupae.

Bureau of India Standards (BIS) – Bureau of India Standards (BIS) is a statutory body set up under the Bureau of Indian Standards Act, 1986. It is responsible for formulating standards and product certification for industrial development, technological needs, export promotion, consumer welfare, health, safety, etc.

Business plan – Business plan is a necessary document for summarizing the entrepreneur's business aspirations, securing legal authorization and mobilizing the resources to launch the business.

Cantharophily – Pollination by beetles.

Capital – Capital is the money available to invest or the total of accumulated assets available for production. Capital is the contribution to productive activity made by investment is physical

capital (machinery, factories, tools and equipments) and human capital (e.g. general education, health).

Centrifugal force – Centrifugal force is the apparent force, equal and opposite to the centripetal force, drawing a rotating body away from the center of rotation, caused by the inertia of the body. The centripetal force is the external force required to make a body follow a curved path.

Chilled brood – Chilled brood is immature bees that have died from exposure to cold.

Clarifying – Clarifying is the process of removing visible foreign material from honey or wax to increase its purity.

Clarifying Tank – Clarifying Tank is a tank or holding vessel that is use to temporarily store honey while the wax and other material separate from the honey.

Colony – Colony (in beekeeping) refers to a group of honeybees with one queen bee who is the female parent of the colony, a few hundred drone bees and thousands of worker bees.

Comb Foundation (Sheet) – Com foundation is a commercially available structure consisting of thin sheets of beeswax with the cell bases of worker cells embossed on both sides in the same manner as they are produced naturally by honey bees.

Consumer – Consumer is the customer who buys the goods and services for consumption.

Cost – Cost is the total money, time and resources associated with the purchase of goods or services.

Cost of production – Cost of production includes all the resources used in producing goods and services, for which the owner receives the payment.

Costing – Costing is the way business calculates the total costs of making and selling a product or providing a services.

Cross pollination – Movement of pollen between blossoms of one variety of plant species and a second, compatible and variety to produce hybrid seed.

Dearth period – Dearth period refers to a period when there are not enough sources of nectar and pollen in the surroundings due to low availability of bee-flora and extreme climatic conditions.

Decoy hive – Decoy hive is a hive placed to attract stray swarms.

Diapause – A hibernation like state in insects.

Direct cost – Direct cost includes all those costs that are directly related to the products or services that businesses makes or sell. Some of the items that are classified as direct cost includes(i) materials, and (ii) salary and wages of labour deployed.

Disease – Disease is any malfunctioning of host cells and tissues that result from continuous irritation by a pathogen or environmental factor and leads to development of symptoms.

Division of labour – Division of labour refers to workers performing a narrow range of tasks (or just one task) in a production process. **Drawn comb** – It is simply comb that is ready for either honey/pollen storage or ready for brood.

Ectoparasite – A parasite, such as a flea, that lives on the outside of its host.

Endoparasite – A parasite, such as a tapeworm, that lives inside its host.

Enterprise – Enterprise is a venture characterized by innovation, creativity, dynamism, and risk. Entrepreneur is a person who organizes productive resources to produce goods and services.

Entomophily – Pollination by insects.

Entrepreneurship – Entrepreneurship is the practice or starting new business or organizations or revitalizing mature business or organization in response to identified opportunities.

Feeder – Feeder is device for giving food in the form of sugar syrup to honey bees.

Fermentation – Fermentation is the process of yeast (a fungus) utilizing sugar as a food and produce alcohol
as a byproduct.

Field bee (forager/ forage bee) – Worker bee that travels outside the hive to collect nectar, pollen, water and propolis, a waxy substance that bees use in the hive as cement.

Floral fidelity – Consistent visitation of flowers from a single plant species by an individual

Food Grade Plastic – Food Grade Plastic does not contain dyes or recycled plastic which could be harmful to humans.

Frame – Frame is a piece of equipment made of either wood or plastic designed to hold the comb foundation.

Fungi – Fungi belong to a separate group of organisms whose somatic (body) structure is usually filamentous and branched. They are heterotrophic i.e., they have to live on processed substance that are already assimilated by other organisms. They are often seen on stale bread.

Grafting technique – Removing a worker larva (one day old) from its cell and placing it in an artificial queen cup in order to have it reared into a queen.

Granulation or Crystallization – Granulation or Crystallization is the process of formation of glucose
crystals in honey. Crystallization is most rapid at 14°C and can be reversed by heating. Honey appears lighter in colour after crystallization.

Gross profit – Gross profit is the difference between the selling price and the cost of an item.

Haemolymph – Haemolymph is similar to blood used by all insects that have an open circulatory system.

Hive Tool – Hive Tool is a metal device used to open hives, pry frames apart, and scrape wax and propolis from the hive parts.

Honey – Honey is the nectar or plant sap ingested by bees, concentrated by them and stored in combs.

Honey bees – Honey bees are species of bees, which belongs to the genus Apis. They are social bees which store significant quantities of honey.

Honey Extractor – Honey extractor is a machine in which honey is spun out of cells into a container. **Honey flow** – Period when bees are collecting nectar in plentiful amounts from plants.

Honey supers – Refers to hive bodies used for honey production.

Hygiene – Hygiene refers to the set of practices associated with the prevention of illness and preservation of
health and healthy living through cleanliness.

Hygroscope – Hygroscope is the ability of a substance to attract water molecules from the surrounding environment through either absorption or adsorption. Hygroscopic substances include sugar, honey,
common salt, glycerol, ethanol, methanol, sulfuric acid, iodine and a variety of other substances.

Indirect cost – Indirect cost is a fixed or overhead cost that cannot be attributed directly to the production of a particular item and is incurred even when there is no output. The items that are classified in direct cost include (i) rent, (ii) interest paid on loan, and (iii) electricity.

Melittophily – Pollination by bees.

Myophily – Pollination by flies.

Myrmecophily – Pollination by ants.

Nectar flow – Nectar flow refers to both the quantity and the quality (amount of dissolved sugars) of the nectar secreted by the plant. The nectar flow in an area at a given time is depended upon the species of plants
present and the weather factors affecting those plants.

Nectar flow period – Nectar flow period is the time when nectar is plentiful and bees produce and store surplus honey.

Nectar – A liquid rich in sugars, secreted by nectaries in or near flowers, the raw material for honey obtained from plants.

Net profit – Net profit is the gross profit minus taxes on profit (net Profit = Gross Profit - taxes on profit).

Non-recurring/Fixed cost – Non-recurring/Fixed cost are those expenses which involve starting a business and which are to be paid only one and will not occur again, e.g., Land and Building. It includes those expenses which do not vary from one period to the next.

Nucleus – Nucleus is a hive of bees which consists of two to five frames of comb and used primarily for starting new colonies or rearing or storing queens.

Occupational Hygiene – Occupational Hygiene is the discipline of anticipating, recognizing, evaluating and controlling health hazards in the working environment, with the objective of protecting workers health and well-being and safeguarding the community at large.

Overhead – Overhead is an expense that cannot be attributed to any one single part of the enterprise activities.

Package – Package means a box, bottle, gasket, tin, barrel, case, bag, wrapper or other items used to protect, contain or transport a commodity or product.

Package bees – Package bees are the certain quantity of adult bees or without a queen, contained in a screened shipping case with a new colony.

Packing – Packing is the process of placing product or products in protective packaging.

Pathogen – Pathogen is a biological agent that causes disease or disorder to its host.

Pesticides – A chemical designed to kill a pest.

Pests – Pests are harmful animals or organisms including fungi and viruses.

Phalaenophily – Pollination by moths

Planning – Planning is the process of setting objectives, or goal, and formulating policies, strategies, and procedures to meet them.

Pollen basket – An anatomical structure on hind legs of the bees where pollen is carried

Pollen substitute – Pollen substitute is any material such as soybean flour, powdered skim milk, brewer's yeast, or a mixture of these used in place or pollen as a source of protein to stimulate brood rearing.

Pollen supplement – Pollen supplement is a mixture of pollen and pollen substituted used to stimulate brood rearing typically in early spring to encourage colony expansion.

Pollen Trap – Pollen Trap is device for removing pollen loads from the pollen baskets of bees.

Pollen – Male reproductive cells of flowers collected and used by bees as food for rearing their young. It is the protein part of the diet. It is also called as bee bread when stored in cells in the colony.

Pollinator – An agent that transfers pollen from one flower to another

Profit – Profit is the positive gain from an investment or business operation after deducting all the expenses incurred on producing the good or service.

Profit margin – Profit margin is the difference between your selling price and all of your costs.

Propolis – Propolis is a sap or resinous materials collected from trees or bud of plants by bees and used to strengthen the comb and to seal cracks; also called as bee glue.

Protozoa – Protozoa are unicellular organisms, they have a well – defined cellular structure with a clear nucleus and other organelles.

Psychophily – Pollination by butterflies

Quality – Quality is the totality of features and characteristics of product or service that bear on its ability to satisfy stated or implied needs.

Queen cage – Queen cage is a small cage in which a queen and three to five worker bees are confined for shipping and introduction into a colony.

Queen cell – A special elongated cell resembling a peanut shell in which the queen is reared; usually over an inch in length, it hangs vertically from the bottom of the comb.

Queen excluder sheet – A device made of wire or zinc having perforations, which permits workers to pass but excludes queens and drones; used to confine the queen to a specific part of the hive, usually the brood chamber.

Queen right – Queen right refers to the conditions when a hive has a queen that is laying eggs.

Queen – A fully developed mated female bee responsible for all the egg laying in a colony.

Queenless hive – Queenless hive is referred to a beehive that does not have a queen.

Recurring/Operating costs – Recurring/Operating costs are those expenditures arising out a current business activities, e.g., rent on building, rent on machinery, salaries, electricity, etc.

Refractometer – Refractometer is an instrument that measures the refraction of light as it passes through a glass prism on which a few drops honey have been smeared. It is used to measure water content.

Requeening – Requeening is the process of taking out an old queen from a beehive and putting in a new queen.

Royal jelly – Royal jelly is a glandular secretion of worker honeybees, which is mixed with some regurgitated (repeatedly taken in and out) carbohydrates and fed to the young bees.

Sifting – Sifting means to put through a sieve.

Smoker – Smoker is a device in which materials are slowly burned to produce smoke which is used to subdue bees, but not harm them.

Start-up capital – Start-up capital is the money needed to start a new business or enterprise. It is used for payments in the business before money from sales can cover the payments.

Subsidy – Subsidy is a payment by the government to producers or distributors in an industry to prevent the decline of that industry (e.g., as a result of continuous unprofitable operations) or an increase in the prices of its products or simply to encourage it to hire more labour.

Sugar syrup – Feed for bees, containing sugar and water in ratio of 1:1.

Supersedure – Supersedure is the natural replacement of an established queen in the same hive.

Swarm – Swarm is a large number of worker bees, drones, and usually the old queen that leaves the parent colony to establish a new colony.

Swarm Cells – Swarm Cells are queen cells usually found on the bottom of the combs before swarming.

Swarming – Swarming is the natural replacement of an established queen by a newly reared queen in the same hive.

Tax – Tax is a financial charge levied by the government on goods and services produced by individuals, groups and institutions.

Tax subsidy – Tax subsidy is a tax reduction that a government gives a business for particular purpose, usually to create jobs.

Total cost – Total cost is the sum of all the direct and indirect costs on making and selling a product or service (Total cost = Direct cost + Indirect cost).

Uncapping Knife – Uncapping knife is a knife used to shave or remove the cappings from combs of sealed honey prior to extraction.

Uniting – Combining two or more colonies to form a larger colony

Value added tax – Value added tax is a form of indirect sales tax paid on products and services at each stage of production or distribution, based on the value added at the stage and included in the cost to the ultimate customer.

Viruses – Viruses are simple form of life known to us. They are not cellular and lack certain components needed to live and grow on their own, therefore, they depend on the cell that they infect to provide those missing components. They multiply very fast.

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