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Beginning Beekeeping For Kentuckians

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Beginning Beekeeping For Kentuckians

Apiculture

Apiculture, the study and keeping of bees, is a fascinating activity for all ages. Beekeeping is an excellent hobby that can provide extra money and valuable educational experiences in biology and business. In the United States, more than 200,000 people keep bees. If you start, there is probably a beekeeper nearby who will help you.

Honeybees are valuable animals. They pollinate about $10 billion worth of U.S. crops and produce about $150 million worth of honey each year. Unfortunately, they face serious new problems. Two kinds of mites that are parasites of honeybees were brought into the United States and have spread rapidly. Tracheal mites live in air tubes inside bees, making it hard for them to breathe. Varroa mites live in bee colonies and feed on developing bee larvae (*brood*). Both tiny pests attack wild and managed bees and have caused many colonies to die. On top of that, the fierce reputation of Africanized honeybees has attracted negative attention. Many people are working to solve these significant problems.

Bee Biology and Society

Honeybees belong to the order Hymenoptera, which includes other bees, wasps, and ants. Most Hymenoptera have two pairs of clear wings; all have chewing mouthparts. Some, including the honeybee, can suck up liquids. These insects undergo complete metamorphosis, or change in form, during their development. The four life stages are: egg, larva, pupa, and adult (Fig. 1).

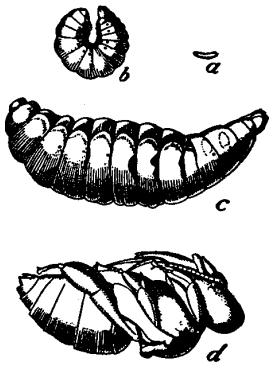


Fig. 1—The honeybee: a) egg; b) young larva; c) old larva; and d) pupa. Three times natural size.

Bees are perfectly equipped to collect pollen and nectar. They are covered with finely branched hairs that trap pollen as they visit flowers. While visiting flowers, the bees gather pollen from their hairs and store it in *pollen baskets* on their hind legs. A tongue-like portion of the mouthpart sucks up nectar.

Although man has managed bees for hundreds of years and carried them around the world, honeybees have not been "tamed." Bees in the most modern apiary follow the same instincts as wild bees that live in hollow trees. Successful beekeepers anticipate and work with or around the bees' natural behavior.

Honeybees are social insects, living together in highly organized colonies. Each member has a specific job to do. A single honeybee cannot grow or survive by itself. The three distinct kinds of honeybees in a colony are queen, worker, and drone.

The Queen

The queen (Fig. 2b) is the longest bee in the hive but has the shortest wings. She is the mother of all the other bees. Her most important job is to lay eggs. Her productivity depends on the amount of food the workers bring in and the amount of brood space in the colony. She can lay more than 1,500 eggs a day. A good queen does not waste any space. She lays a solid pattern of brood, meaning one egg in every cell. Few eggs scattered among many empty

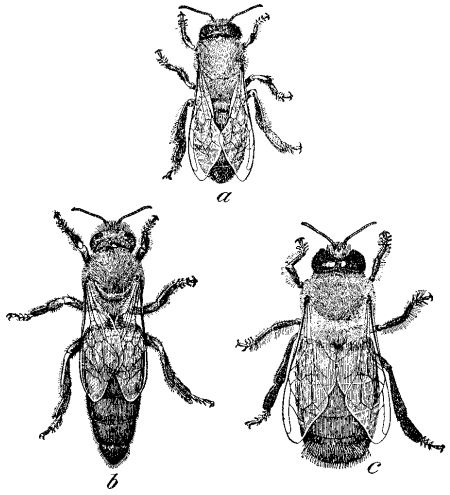


Fig. 2—Three kinds of bees in a hive: a) worker; b) queen; and c) drone.

cells or several eggs per cell are signs of problems. The queen might be missing or old, or parasites or disease might have weakened the colony. It can take some detective work to solve the problem. Your county extension agent can determine what samples to take from the hive to diagnose the problem.

Worker bees usually rear new queens for one of three reasons: 1) the former queen left with a swarm; 2) the queen is laying increasingly fewer eggs; 3) the colony is overcrowded and has no place to expand. A colony that loses its queen suddenly is very upset but soon

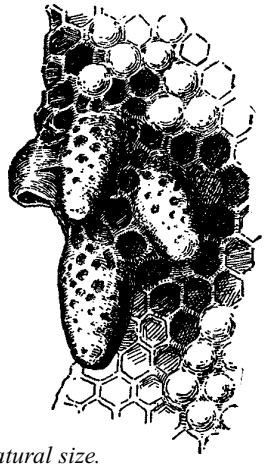


Fig. 3—Queen cells. Natural size.

starts to rear a new one. Worker eggs or larvae less than three days old are raised in quickly built queen cells (Fig. 3) which hang vertically and are about the size and shape of a peanut shell. A fertilized egg hatches in about three days. The larva eats a special food called royal jelly. After growing rapidly for about six days, the larva pupates in the cell. The queen emerges about eight days later.

A newly emerged queen stings the remaining queen cells in the colony and fights any other queens she finds. The former queen is killed if she is still in the hive. Usually she has already left with other bees in the colony. Six to eight days after emergence, the queen takes nuptial flights and mates high in the air with the male (*drone*). Then she settles down and lays eggs. She will leave the hive only with a swarm. (Swarming is the natural way by which colonies are established at new locations.)

Queens live about five years with some living as long as nine, but egg-laying drops off significantly after two years. Many beekeepers keep a queen longer than that; others replace the queen every year to keep the colony strong. Colonies with older queens are more likely to swarm. Swarming usually occurs just before the main nectar flow. Hives that swarm have drastically reduced honey production.

The Worker

Workers (Fig. 2a) are smaller than the queen and drones, but there are lots of them. There might be only a few hundred during winter and early spring, but there are usually many thousands during summer when pollen and nectar are plentiful. A strong colony at full strength can have close to 100,000 workers. These bees keep the colony going.

Life begins as a fertilized egg. Laid singly in cells, each egg is attached to the bottom of the cell and stands upright. Eggs hatch in about three days. Each larva is fed royal jelly for three days then pollen and honey for three more. Pollen and honey are not as rich as royal jelly, so the larva becomes a worker instead of a queen. The white grub-like larva molts (sheds its outer covering) five times during the six days. Just before maturity, house bees cap the cell. The larva then spins a cocoon and becomes a pupa. The adult emerges 12 days later. It takes about three weeks to mature from the egg to an adult bee ready to go to work.

Workers' jobs change with their ages. Young bees, called house bees, do the hive chores. They produce wax and shape it into combs (structures of cells containing honey and brood) and use propolis (a gummy substance gathered from plants) to seal cracks or cover rough edges in the hive. House bees also fan their wings to ventilate the hive in summer, controlling temperature and humidity, and they provide heat in winter. Some guard the hive to keep out raiders. Many produce honey and royal jelly. A lot of time is spent feeding brood and cleaning and repairing cells. House bees also feed the queen, the drones, and each other.

Older workers, or field bees, gather nectar, pollen, and water.

The average adult worker lives less than a month during the busy season; overwintering bees live several months.

The Drone

Drones (Fig. 2c) are larger than workers but not as long as queens. A drone has large eyes that touch each other at the top of the head. Drones do not have stingers, pollen baskets on their legs, or glands for producing wax, and their mouthparts are too short to gather nectar. Moreover, they do not even do jobs they could like ventilating the hive. Their only function is to fertilize the queen, and they die in the process. Drones are banished from the hive before winter begins.

While queens and workers develop from fertilized eggs, drones develop from unfertilized eggs. Drone cells are slightly larger than worker cells (Fig. 4). This stimulates the queen to

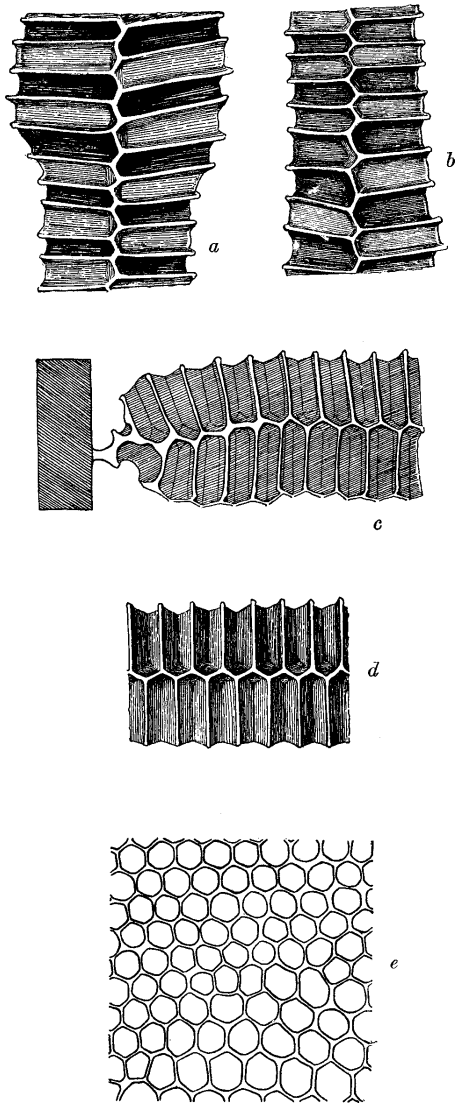


Fig. 4—Comb architecture: a) vertical section at top of comb; b) vertical section showing transition from worker to drone cells; c) horizontal section at side of comb showing end bar of frame; d) horizontal section of worker brood cells; and e) diagram showing transition cells. Natural size.

lay only unfertilized eggs in them. Drone eggs are also laid in worker cells that have become enlarged because of stretched or sagging combs. Small drones develop in worker cells if a queen gets old and loses her ability to fertilize eggs. Total time from egg to adult is 24 days.

The Colony

In many respects a honeybee colony is like a single animal. Individual bees and castes are like the cells and tissues. When one part is threatened, the whole colony reacts. If an essential segment of a colony becomes diseased or destroyed, the colony often can heal itself. It may divide and become two or more separate colonies.

The colony also changes to survive different seasons. Let's follow the life of a colony through a year.

In mid to late summer, only small amounts of nectar and pollen are brought into the colony. Often no brood are being reared, so the colony does not grow. A fall nectar flow usually allows a small crop of young bees to carry through the winter. The colony needs honey for energy and pollen for protein, minerals, and vitamins to survive the winter and raise brood in early spring. Survival depends on a large cluster of young bees and a good food supply. If the cluster is too small, it cannot generate enough heat to survive the winter. Bees die if their body temperature gets much below 57°F. The colony must be able to make and save heat to survive in winter.

Bees produce heat by digesting honey. They save the heat by bunching together in a tight cluster. The outer layer of bees is an insulating shell that traps the heat in the center of the cluster. The bees on the outer layers periodically change places with inside bees so that none of them become too cold. The cluster tightens or loosens depending on the temperature in the hive.

Below 57°F, bees do not work in the hive. They do not even move to get honey that is not next to the cluster. If it stays cold for too many days straight, bees can starve even if honey is just a few inches away. The colony soon runs out of heat and freezes. Even if honey is within reach, they can freeze if there are not enough bees to produce some heat and save it.

A large colony with plenty of food can keep the temperature at the center of the cluster around 90°F. This is warm enough to rear brood. They start doing this in late winter. As spring arrives, increasingly more brood are raised. As pollen and nectar are brought in, empty cells in the hive soon fill with brood and food.

Bees do not like to be crowded. If there is not enough room to add comb, some leave in a swarm. Colonies with plenty of space are less likely to swarm and will continue to grow. Beekeepers can keep healthy, productive bees by managing food and space wisely during the year.

Races of Bees

Honeybees in North America belong to a single species (*Apis mellifera*), but several races exist within that species. Races differ in coloration, temperament, industriousness, hardiness, disease resistance, tendency to swarm, and other characteristics.

No single race is best, but Italian bees have a good balance of desirable characteristics. They are hardy, industrious, and fairly gentle. Italian bees have yellow or brown bodies with varying numbers of dark bands toward the ends of their abdomens. They tend to raise young bees early and late in the year, so they need more honey for maintenance than some other races. Italian bees are a good choice for anyone getting started in beekeeping; however, they are susceptible to tracheal and varroa mite infestations.

Modern techniques have produced hybrid bees that have improved the qualities of the best races. Beekeepers can try queens from different queen breeders to learn more about the behavior and honey production of different strains of the same race. Most strains are gentle when handled under the proper conditions. If the bees are not gentle, requeen immediately with a queen from a gentler strain. There is no correlation between honey production and temperament.

Races of bees are often regarded as one would regard breeds of cattle or dogs. However, they should not be. Unlike domestic animals, honeybee races have not been strongly controlled nor bred only by people. They are much more variable than a breed of domestic animal. Honeybees were not significantly genetically selected by humans until recently because basic bee reproduction was not understood until 1845.

Africanized Honeybees

Originally, honeybees were brought to America by European settlers. In 1956, researchers in Brazil were trying to develop a more productive honeybee. They imported queens from Africa because they thought their offspring would be better suited for Brazilian conditions. Unfortunately, some African swarms escaped into the countryside where their queens interbred with the gentler European honeybees. While "Africanized honeybees" have been in Texas for several years, few serious stinging incidents have occurred.

These bees defend their nests more fiercely than European honeybees and swarm more often. Africanized honeybees became known as "killer bees" because of some widely publicized stinging incidents. Venom from an Africanized bee is no more potent than that of a single European honeybee. However, they are quicker to attack anything that enters their territory or approaches the nest, and larger numbers fly to the intruder. Most stinging incidents have involved animals but humans also can be attacked. In some cases, the noise or vibration of tractors or mowing equipment has provoked the bees to sting. Chance encounters with individual Africanized bees on blossoms pose no greater threat than encounters with European honeybees. Even though mass attacks are terrifying and could be life threatening, they are not common. The best defense for avoiding stings from all stinging insects is common sense.

Before You Begin Beekeeping

Before starting to keep bees, consider these points. Some people are allergic to bee venom and can become seriously ill or even die as a result of just one sting. Even if you are careful, stings are bound to occur when working with bees. If you are sensitive to stings, you should not keep bees.

Neighbors who fear bees might not want hives nearby. Also, local laws might not allow bees in residential areas. Always obey the law and be a good neighbor! Keep your colonies away from areas where people will get in the way.

Successful beekeepers, beginners or experts, are always learning about apiculture. They often belong to local or state clubs where they can share ideas and experiences with others. Books and magazines are also good ways to get information. Beekeeping suppliers often offer a beginner's package to get you started.

A beginner's package has:
a 10-frame hive body
10 deep frames
10 sheets of wired brood foundation
1 bottom board, an inner cover, and a top cover
a smoker and hive tool
1 bee veil and a pair of bee gloves
1 Boardman feeder

Put the hive body and frames together and install the foundation before the bees arrive. Two to three pounds of bees with a queen will be delivered at a later date.

You will soon need:
10 to 25 pounds of granulated sugar to feed package bees
1 bee brush
1 queen excluder
2 to 4 shallow supers
20 to 40 shallow frames
20 to 40 sheets of unwired foundation to match the frame style

Basic Beekeeping Equipment

The Hive and Its Parts

Honeybees can live in hollow trees, wall voids in buildings, attics, or any other protected place. Several types of hives have been designed to manage honeybees. Old-fashioned hives were simple devices, such as plain boxes, short sections of hollow logs called gums, or straw baskets called skeps. These hive styles have many disadvantages and are rarely used now. Combs in them were usually irregular and braced together with bur comb. Individual combs could not be removed from the hive without damaging other pieces or even injuring or killing the queen. It was also difficult to inspect the hives for diseases and other problems.

Modern hives (Fig. 5) with *movable frames* allow easy inspection and honey removal. Hive design is efficacious for other management practices and for the bees. The inner dimensions of the hive and its parts are very precise. They are based on a dimension called the "bee space," which is about 5/16-inch wide or deep. Proper spacing is important. If gaps are too wide, bees build brace comb and glue down movable frames. The modern hive consists of several parts.

A *hive stand* keeps the hive off the ground so it is less likely to rot, flood, or be attacked by termites. It can be as simple as a few bricks stacked under each hive corner, or it might be a wood frame with an alighting board. The alighting board allows heavily loaded field bees to land more easily before crawling into the hive.

The hive rests on the three rails of the *bottom board*. The open side is the hive entrance.This opening can be closed or narrowed with an entrance cleat when necessary. Reducing the entrance opening in the fall keeps out field mice looking for shelter.

The standard *hive body* or *brood chamber* holds 10 frames of comb. Besides being the nursery, it is also pantry, kitchen, living room, dining room, bedroom, and workshop for the bees. If it becomes too crowded, the bees might begin rearing brood in the supers. If colonies get very large, provide extra hive bodies for the brood chamber.

A *queen excluder* (Fig. 6) is sometimes placed above the brood chamber to keep the queen in the brood chamber. Slots in the excluder are wide enough workers can go back and forth but too narrow for the queen to pass through. Beekeepers who produce extracted honey do not use excluders because they reduce the bees' efficiency. For comb honey and chunk honey production, the excluder assures that brood are not in the honey product.

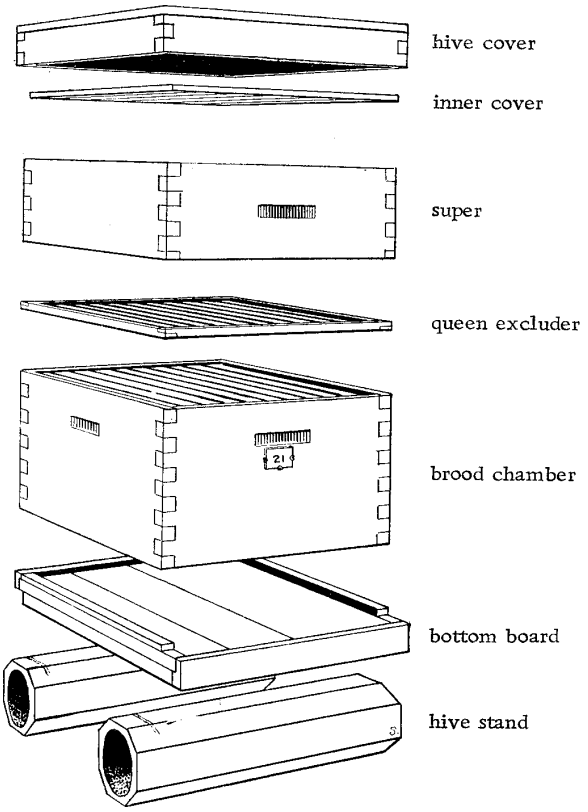


Fig. 5—A 10-frame hive with comb-honey super and perforated zinc queen excluder.

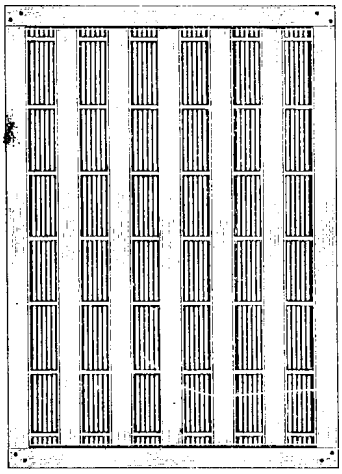


Fig. 6—Queen excluder.

Chambers above the brood chamber are called *supers*. They are the same size as the brood chamber and are used for storage of surplus honey. Deep supers are used by those who primarily produce extracted honey. Larger boxes require less handling but are heavy when full of honey. Shallow supers are easier to lift and convenient for harvesting small honey yields from a particular nectar source.

The *inner cover* is a flat piece with an oblong hole in the center. A bee escape can be put in the hole when needed. The hole provides ventilation and a place to puff smoke when opening the hive. The edges of the inner cover have railings on both faces. The railing on one side is higher than the other. The tall railing should

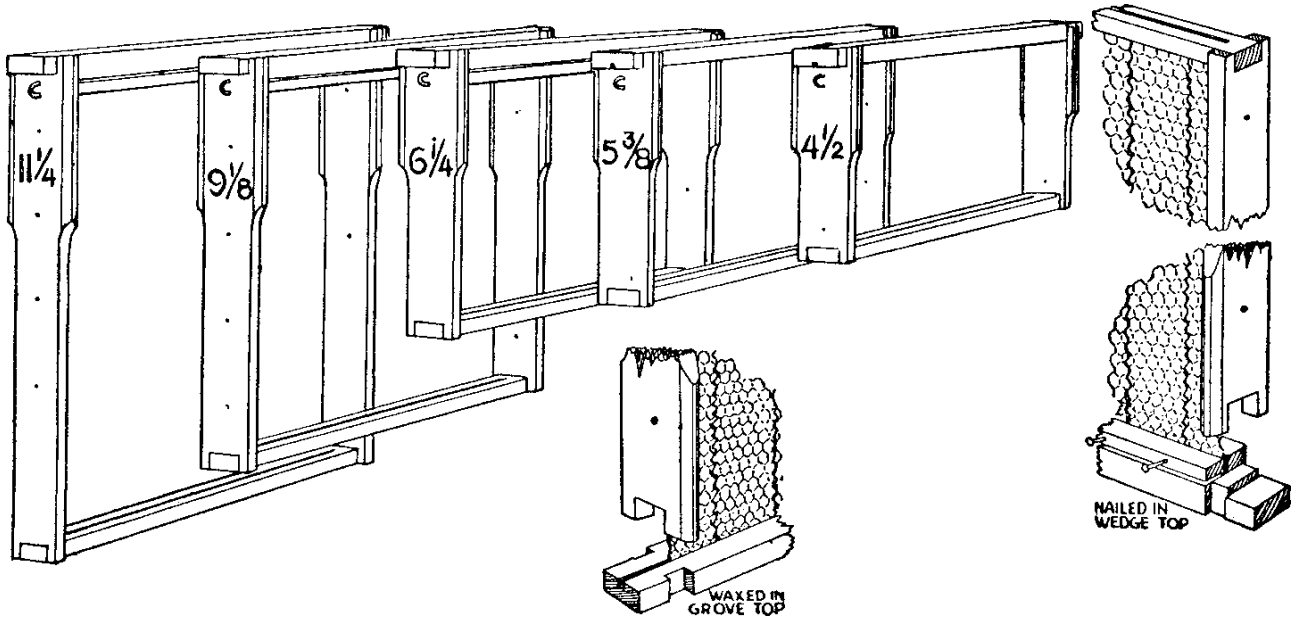


Fig. 7—Standard frames.

be on the outside. If the tall rail is on the inside, the bees build wax between it and the tops of the frames. This buildup is a mess to clean.

The *top cover* is a waterproof lid that rests on the edges of the top super. Bees do not glue down the top cover, so it can be lifted from the hive without prying or jarring.

Frames (Fig. 7) are the inside parts that hold the comb. They consist of a top and bottom and two end bars. The wide part of an end bar is keeled on one edge. Place frames in the hive so that the keeled edge of one frame abuts the flat edge of the next one. Frames help keep comb-building regular and allow easy inspection and honey removal. All frames are the same length, but there are different depths and styles.

Carefully put together unassembled frames. Fit the frame together so that the keel on the left end bar is toward you and the keel on the right end bar is away from you. If you rotate the frame, the keel is still toward you on the left side and away from you on the right. Use plenty of nails when fastening the frame together. Otherwise, it can pull apart when the comb is full of honey.

To ensure that the comb is regular, frames are fitted with thin sheets of embossed wax called *foundation*. Foundation for brood frames and extracted honey frames has embedded wires for extra strength. This prevents the comb from sagging when the wax gets soft during hot weather or from tearing apart during extraction.

Foundation can be purchased with wires in it, or wire can be embedded after foundation is fitted into the frame. It is more convenient for the beginner to buy wired foundation for brood frames. Use unwired foundation in the honey frames if you are going to produce chunk honey. The size of foundation sheets varies with frame size. Bee supply catalogs specify the frame styles different foundation sheets fit.

Other Beekeeping Equipment

A *hive tool* (Fig. 8) is the most useful piece of beekeeping equipment. It can be used to pry up the inner cover, pry apart frames, scrape and clean hive parts, and do many other jobs.

Examining a hive is much easier when you use a *smoker* (Fig. 9). It is used to puff smoke into the entrance before opening the hive and blow smoke over the frames after the hive is opened. Smoke causes the bees to gorge themselves with honey; then they are much gentler. Smoke must be used carefully. Too much can drive bees from the hive. They will be slow to settle down after the hive is closed again. Burlap, rotted wood, shavings, excelsior, cardboard, or cotton rags are good smoker fuels.

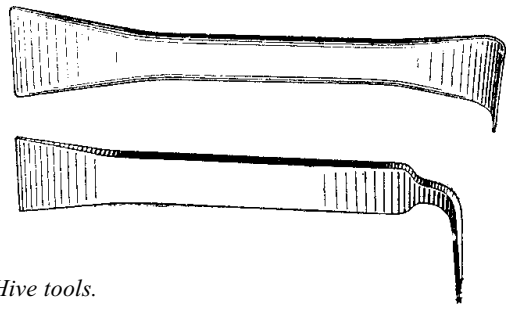


Fig. 8—Hive tools.

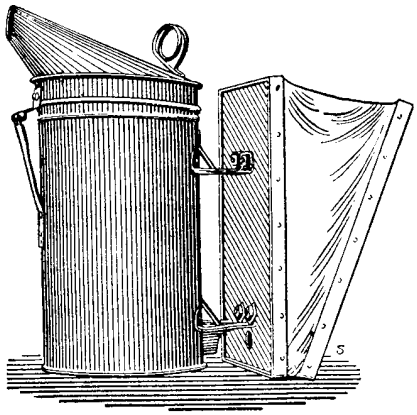


Fig. 9—Smoker.

Even the most experienced beekeepers wear *veils* (Fig. 10) to protect their face and eyes. Wire veils keep bees farther away from the face than those made of cloth. Black veiling is generally easier to see through. Some beekeepers prefer to wear a

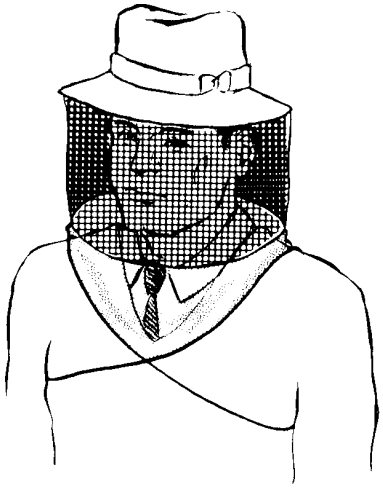


Fig. 10—Protect face and eyes from stings with a bee veil.

bee suit. Whether or not a suit is used, a beekeeper's clothing should be light in color. Bees generally do not like dark colors and will attack dark objects.

Bee gloves (Fig. 11) protect the hands and arms from stings, but it is hard to do some jobs while wearing them. It is a good idea to wear gloves until you feel more comfortable working your bees.

A *brush* (Fig. 12) gently removes bees from frames. A leafy twig or bunch of grass can do the same job and gives you fewer tools to carry around.

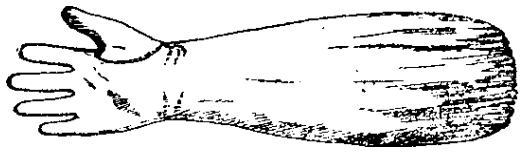


Fig. 11—Bee glove with fingers.

Fig. 12—Bee brush.

A *bee escape* (Figs. 13, 14) is used to clear bees out of supers. Place the escape in the center hole of the inner cover below the super to be cleared. Bees can pass through in only one direction. It usually takes about a day to get the bees out of a super.

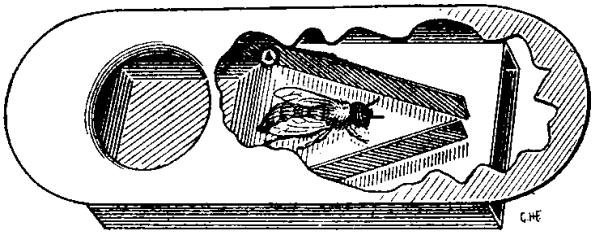


Fig. 13—Spring bee escape.

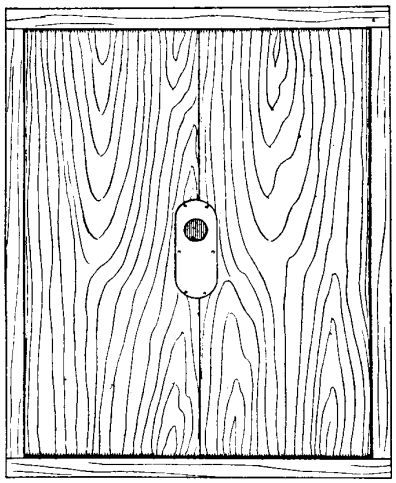


Fig. 14—Bee escape in board.

Fig. 15—Spur embedder.

Wire embedders (Fig. 15) are handy for wiring your own foundation. Various jigs for assembling frames and supers save time and assure square fitting. These can be purchased or made. Most beekeepers are creative with tools and make various gadgets to do special jobs.

How to Get Bees

Most people begin beekeeping by capturing a swarm or getting bees from an established beekeeper. It is much easier to purchase package bees from a reliable bee breeder than to remove them from nests in buildings or trees. This method requires a lot of time and effort. Also, wild bees can be diseased or infested with mites, have a bad temperament, or be poor producers. You will get a better strain of bees from a professional. They select bees for characteristics such as greater honey production, gentleness, disease resistance, and better wintering qualities.

Hiving Package Bees

The season for shipping bees is short and the supply can be limited. Place your order in winter and give the delivery date you want. Plan to have package bees arrive six to 10 weeks before nectar flow begins. If you are not sure when that is, schedule the arrival for early or mid-April. Before the bees arrive, your hive should be assembled, fitted with foundation, and set up in a good location.

When the shipment arrives, examine it carefully. There are always a few dead bees. If most of the swarm or the queen is dead, immediately report it to the company. It is usually better to request replacement rather than a refund.

If the weather is hot when the bees arrive, put them in a cool dark room that is not over 70°F. While the bees are adjusting to the temperature change, smear the screened sides with sugar syrup. Feed the bees repeatedly until they are engorged. They will be much quieter to handle.

Install the bees in the hive late in the afternoon when tendency to drift is lessened. Open the hive and remove four frames from one side to allow space for the bee package. Use the entrance cleat to narrow the hive entrance to three inches. Remove the shipping strip from the top of the cage and shake the bees to the bottom of the cage. Take out the queen cage. Remove the pasteboard over the candy end of the queen cage and use a small nail to punch a hole through the candy. Do not make the hole so large that the queen can get out immediately. Suspend the queen cage, screen side down, between two center frames.

Remove the feeder can and shake some of the bees over the queen cage. Place the partially emptied package, top side up, in the empty space left by removing the four frames. Some beekeepers prefer to shake out all the bees over the queen cage and not take out the four frames. Place the inner cover upside down on the hive and place the feeder can, feeding holes down, over the hole in the inner cover. Add an empty super to house the feeder can and then put on the outer cover.

Leave the colony alone for a week except to feed them syrup if necessary. If the queen has not escaped from her cage by then, let her out. Remove the queen cage and shipping cage and replace the missing frames. Continue to feed the bees until nectar begins to flow and the colony is strong enough to begin storing honey in the super.

Hiving a Swarm

You can increase your numbers of hives by collecting swarms. Let your fire department, police or sheriff, and county extension office know you are interested in bees. Often people call these agencies when they see swarms.

Swarms settle in all kinds of places, so there is no single procedure for capturing them and putting them in a hive. Have your equipment ready during the swarming season so you can go to a swarm on short notice.

After a swarm leaves a hive it might settle on a nearby tree, fence post, side of a building, or other similar object. Swarms near the ground are relatively easy to capture. Put cloth sheet on the ground by the bees and place a hive or box on it.

A smoker can be used to drive the bees toward the entrance of the hive, but they usually enter on their own. Carefully brush clustering bees toward the entrance using a handful of smooth leaves or weeds. After the first brushing, place the telescoping inner and outer covers on the hive so bees are attracted toward the entrance.

It is more difficult to capture a swarm that has settled high in a tree. Often the limb may be cut off and carefully lowered to the ground. Remove the covers of the hive and give the branch a sharp, quick shake to dislodge the bees over the combs and entrance. After the bees begin a steady movement into the hive, replace the covers. After the swarm has become settled in the hive, it should be moved to a permanent location the same evening or early the next day.

Transferring Bees to Modern Hives

Once in a while you might want to transfer bee colonies from nonstandard hives or from a standard hive in which the combs are messed up. You might even want to salvage a colony from the attic of a building. Sometimes transferring bees is not worth the effort. It involves a lot of work, and the colony might be diseased or infested with mites. If transferring seems worth the risk, you can use several methods.

Prepare a new hive body with a full set of frames and wired brood comb. Bees usually accept old, dark comb more readily than they accept new comb or foundation. Place this hive body on top of the brood chamber to be transferred. Brood rearing tends to move upward in the hive, so the colony gradually transfers itself into the area. This takes about a month. When all the brood have emerged from the old hive, remove it and melt down and salvage the wax.

You can speed the transfer process by smoking the queen and workers into the new hive body, and then placing a queen excluder between the old and new hive bodies. The excluder allows workers to tend brood in the old hive but forces the queen to lay eggs in the new hive. The old hive will be clear of worker brood in 21 days.

Basic Beekeeping Operations

Hive Location

While bees can fly up to two miles to find nectar and pollen, they do best with less "travel time." Bees can be kept almost anywhere; they do not have to be in a "perfect" spot. Choosing the best possible location (Fig. 16), however, increases

Fig. 16—A well-located apiary.

the chances for a strong, productive colony. Consider both the bees and your neighbors when making your decision. Some points to keep in mind are:

1. Bees need water to dilute honey and cool the hive during hot weather. If water is nearby, they can spend more time gathering nectar and less time collecting water. If necessary, a dripping garden hose or water trough filled with coarse gravel may be placed near the hive. Bees will drown in deep open water containers.

2. Bee behavior is affected by temperature. They rarely work when the temperature is below 57°F or above 100°F. They cannot fly when the temperature is below 55°F. On very hot days, bees cluster outside unshaded hives and do not work. However, too much shade in the summer makes bees irritable.

3. Windbreaks provide some protection from cold winter winds. Bees eat more stores and are more susceptible to dysentery when located where cold winds hit the hive.

4. Field bees orient themselves with the sun and usually fly from mid-morning to mid-afternoon. Avoid placing hives on the west or north sides of buildings. Orient the hive entrance to the south or southeast but not into prevailing winds.

5. If you are in hilly country, locate your hive in a valley. Bees fly uphill for nectar and downhill when loaded with pollen or nectar. Locate the hive so you can carry filled supers down the slope to your storage area.

6. Locate your bees close enough to your home to observe them regularly.

7. Hives near highways, sidewalks, or watering troughs might be a nuisance. If your hive is in this situation, build a high fence so bees leaving and returning to the hive must fly over the area.

8. Avoid locating the hive near large rivers bees must cross to forage. Bees within a half mile of wide rivers often drop into the water and drown when returning home tired and loaded with nectar.

9. Bees will fly two miles in any direction over level ground for nectar, but honey production increases if nectar is closer. Try to locate the hive near fall and spring nectar sources.

Examining the Colony

"Going through the bees" is a phrase beekeepers use for opening the hive to examine the condition of the brood and food stores and look for signs of disease, swarming, or anything else that needs attention. During off-seasons, especially winter, monthly inspections are generally sufficient. During the six-week period from the beginning of rapid colony buildup to the beginning of the spring nectar flow, examine the colony weekly.

When opening a hive, take precautions to avoid harm to the bees and yourself (Fig. 17). Most danger is avoided by working slowly and carefully and wearing the appropriate protective gear. The most important item is the bee veil because stings around the eyes or temples are more dangerous than stings elsewhere. Also, reacting suddenly to stings around the head entices more bees to sting.

Fig. 17—Opening a hive.

Bees dislike dark, woolly, or sweaty materials, so wear clean, light-colored, cotton coveralls or a long-sleeved shirt and full-length pants. Tuck your pants cuffs into your socks and your shirt cuffs into your bee gloves, or tie your pants and shirt cuffs so bees can't get in. Bees have a harder time stinging through loose clothing, but do not wear clothing that flops about. Many beekeepers are toughened enough to tolerate a few stings on the hands so they often do not wear gloves, which are slightly cumbersome. However, it is best to wear gloves until you know how you will react to stings on the hands. Dropping a frame of bees or swatting at a stinging bee only makes things worse.

Weather and other conditions influence the temper of bees, so examine the hives under the most favorable conditions. During a nectar flow, bees work from mid-morning to mid-afternoon on calm sunny days when the temperature is above 70°F. Bees are more even-tempered when they are busy. Also, when most of the field bees are out foraging, fewer are in the hive to interfere with your inspection. Bees tend to be irritable between nectar flows or on poor flying days. When bees are actively brood rearing, avoid opening the hive on cold, overcast, or windy days lest the brood be killed by chilling.

Your smoker should be lit and smoldering properly before approaching the hive. Move to the hive from the side or rear; stay out of the line of flight. Move slowly and avoid making quick or sudden motions. Reach around to the front of the hive and give the entrance two or three puffs of smoke. This disorganizes the guard bees and distracts the others from what you do next. Quietly remove the top cover and place it upside down on the ground to the rear of the hive. Puff some smoke through the hole in the inner cover, wait a few moments, then pry up the inner cover with your hive tool. Puff a little more smoke under the cover as you lift it off. Lean the cover against the hive. Use additional smoke if necessary, but do not overdo it. A little smoke stimulates the bees to fill up on honey and be peaceful; too much smoke drives them from the hive and disrupts their workday.

Bees glue contact points together with propolis, so frames must be pried loose with the hive tool. Insert the tool between the hive wall and the ends of the frames to pry them loose. Then pry between the outside frame and the one next to it to separate them from each other. Remove the outside frame, which usually contains no brood, and stand it on end against the shady side of the hive. There is now space in the hive to shift the remaining frames. They can be removed, examined individually, and replaced. Do not set any of these frames down outside the hive. Examine as few frames as possible to assess the condition of the colony. Keep the hive open only as long as necessary to judge its condition.

Avoid crushing bees when shifting or replacing frames, especially the queen. Crushed bees emit an odor which excites other bees to sting. After a nectar flow, do not keep a hive open for more than a few minutes at a time. Otherwise, bees from other colonies might begin robbing. Robbing results in heavy bee loss. If it starts, put the hive back together immediately and place some grass in the entrance to help the bees repel robbers.

When looking at the frames, hold them vertically by the ends of the top bar (Fig. 18). Stand so that the light comes over your

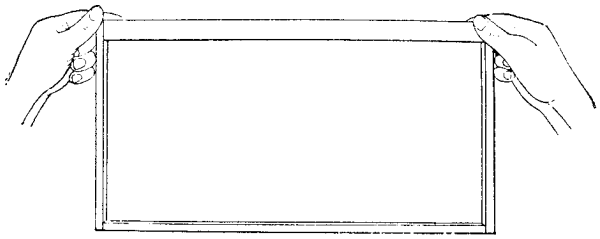


Fig. 18—Handling the frame: first position.

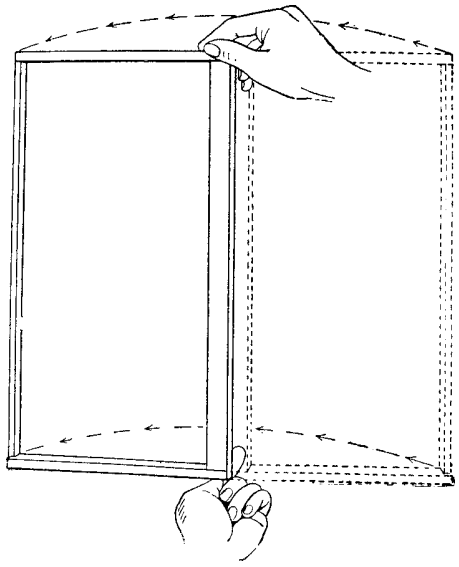


Fig. 19—Handling the frame: second position.

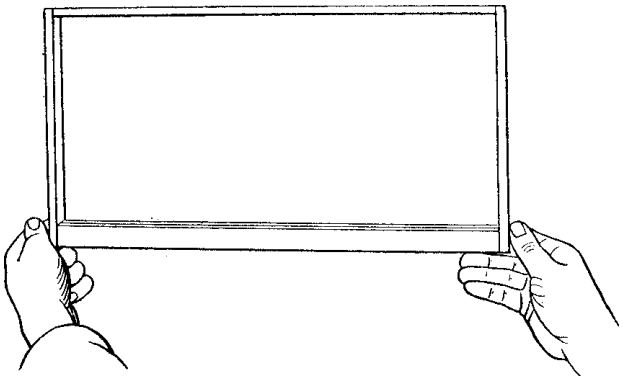


Fig. 20—Handling the frame: third position.

shoulder. To see the opposite side of the frame, raise your right hand until it is above your left hand and rotate the frame like a hinged door until the opposite side is in full view (Fig. 19). Then bring your right hand down level with your left. The frame will be upside down in your hands (Fig. 20). Depending on the season, things to look for are:

1. Is there sufficient honey and pollen?

2. Is the queen healthy? If eggs and brood are present, the queen is probably all right.

3. Are swarm cells present? If so, destroy them and check further for conditions that might cause swarm preparation.

4. Is there enough room for the queen to lay and for the workers to put away stores?

5. Are the combs broken or sagging or with many drone cells?

6. Is the brood diseased? Are there sufficient worker bees? Too many drones might be a sign of a failing queen or poor combs.

Record your observations in a notebook immediately after hive examination. Look back at this information to review the season's activities and plan for next year.

Bee Stings

All honeybee workers are potential stinging insects but usually sting only to defend their colony or themselves. To avoid stings, do not pass directly in front of a colony of bees. Instead, work from the side or back. If a flying honeybee comes near you, remain still or walk to a brushy area, building, or vehicle. Swatting at bees aggravates them.

If you are stung, remove the stinger immediately by scraping it with your fingernail or a knife. Do not squeeze the stinger. This injects the full dose of venom into your skin. The scent of the poison often alarms and irritates additional bees, so either wash the wound site with a natural odor or apply a few puffs of smoke to mask the scent. Rubbing the wound only produces more itching and swelling.

Persons made ill by one or several stings ordinarily should not attempt to work with honeybees. Evidence of oversensitivity to bee stings includes a sharp change in the pulse rate, difficulty in respiration, loss of consciousness, and hives on various parts of the body.

Requeening

Many queens live five years and some up to nine years, but vitality decreases with age. The aging process is hastened by a high demand to lay eggs. Most beekeepers prefer to replace the queen before she begins to fail. This can be a yearly process, but in our area most requeen every other year. Requeening is relatively inexpensive, especially when you consider the production loss and generally weakened colony due to a failing queen.

A queen may begin to fail at any time so always check her condition. Several symptoms can alert you to the problem. An old queen usually has a dark dull appearance because her body hairs have been broken or rubbed off. The edges of her wings might be worn and ragged and her abdomen might droop away from her thorax. She moves more slowly and might avoid the workers. Also, very old queens lay mostly drone eggs. The brood area of a failing queen is smaller than normal or "scattered" on the comb. Honey production is down even when production conditions are favorable. The workers build supersedure cells near the center of the comb in preparation for replacing a failing or missing queen. At this point, it might be just as well to let the queen be superseded rather than purchase a new queen. However, it is best not to let the situation deteriorate to this point. If the queen is missing for an extended period of time, workers might begin to lay unfertilized eggs. These eggs only produce drones. Unlike the queen, laying workers deposit several eggs in each cell. It is often difficult to requeen a colony that has been queenless for some time.

Requeening can be done at several times. Select a period when nectar is coming into the hive. This improves the chance of the new queen being accepted. The earliest time in the year is in spring when bees are bringing in nectar about six to eight weeks before the main nectar flow. The advantages then are few supers to handle and a relatively small colony. Also, the old queen is easier to locate, and it's easier to check for acceptance of the new queen. A disadvantage is the higher cost of queens during this time.

Some beekeepers requeen after the main nectar flow begins. If the old queen has been laying fairly well, she will have laid most of the eggs needed for a good work force. The disruption of brood rearing by introducing a new queen is only slight. A disadvantage is difficulty working through the large number of bees to locate the old queen.

Requeening can be done in the fall if there is a dependable nectar flow. The colony is not overly large at this time, and a good queen will be established for the spring buildup.

The simplest requeening method is to introduce a purchased queen from the mailing cage. About midday, as soon as possible after the queen arrives, open the hive using as little smoke as possible. Remove the brood chamber combs one by one, checking each one carefully for the old queen. When you locate her, kill her and destroy any queen cells present. Uncover the candy hole in the end of the mailing cage and punch a small nail hole through the candy. Suspend the cage in a horizontal position between the top bars of two center frames of the brood chamber (Fig. 21). Close the hive, and do not disturb it for seven days. At the end of this time check to see if the new queen has been accepted. Look first at the mailing cage to see if she is free. If she is not, enlarge the candy hole or release her directly into the hive. If the queen is free and eggs are present in brood cells, it is not necessary to locate her.

Fig. 21—Queen cage in place.

Swarming and Its Control

A beekeeper can use one of several artificial methods to increase the number of colonies, but the natural method by which bees increase colonies is swarming. Swarming reduces honey production for the season because the parent colony and the swarm each have fewer bees than the original colony. They do not build to full strength as quickly as the original colony would have if swarming had not occurred.

When preparing to swarm, bees build large numbers of queen cells along the bottom of the comb. Shortly before a new queen emerges, the bees stop their field work. The swarm bees, usually at least half the bees in the colony, engorge with honey. They leave with the queen, fly a short distance, and cluster on a bush or tree limb. They wait there while scout bees locate a satisfactory hiving place. During the wait, the bees are very gentle and can be handled with much less danger of stinging. If scout bees come back with news of several satisfactory hive sites, the swarm somehow selects one. The dense ball of bees breaks up into a boiling cloud and flies directly to the new hive.

After the first swarm leaves the old hive, new queens may lead other swarms from the hive within a few days of each other. After all the swarming is over, normally enough bees are left in the old hive to keep it going although the colony strength might be greatly weakened.

The impulse to swarm is governed partly by the innate character of a bee colony and partly by conditions in the hive. Some races of bees tend to swarm more than others. However, swarming is most often associated with overcrowding in the hive. Overcrowding can result from a variety of unsatisfactory hive conditions (Table 1) including lack of supers, improper super sequence, poor comb spacing, poor ventilation, too many young bees or drones, and combs filled with honey.

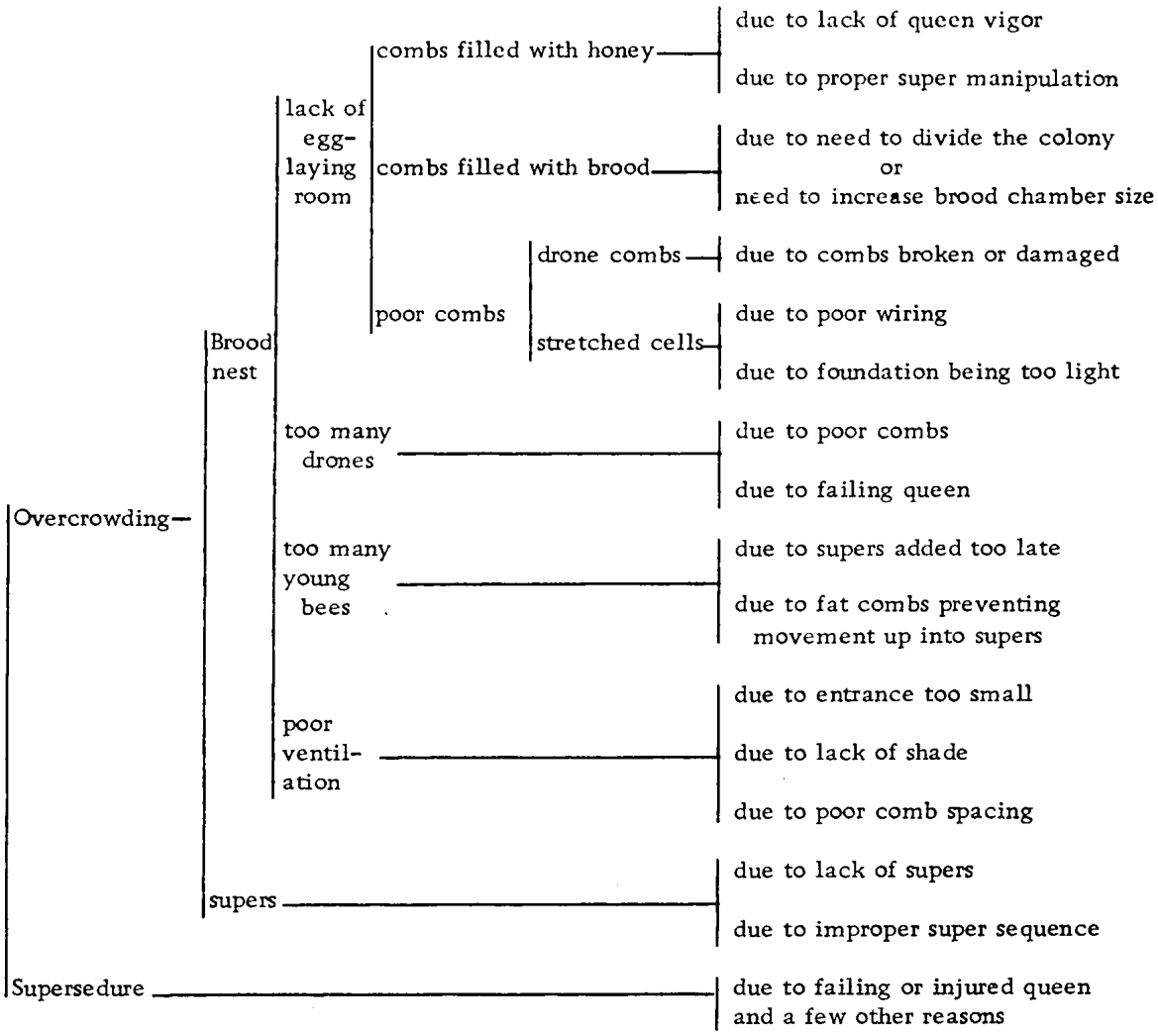
A common time for overcrowding is when pollen becomes abundant in spring and prompts a rapid increase in brood rearing. Brood cells are filled with brood faster than they are emptied by the emergence of new bees, so the area containing brood expands. The area being filled with nectar and pollen also increases. If space is not provided to accommodate this expansion, swarming is apt to occur.

During the spring buildup, inspect the colony weekly to see that ample space is provided for brood rearing and honey storage. Brood chambers need to be added if the colony overwintered with one hive body. If the colony has more than one brood chamber, chambers should be rearranged to best accommodate the expanding brood. Normal colony behavior is to expand the brood nest upward, so put brood chambers that are empty or contain the oldest brood on top and the chamber with the youngest brood on the bottom. Brood chambers might need to be rearranged every two to three weeks until the nectar flow starts. After the nectar flow starts honey supers should be added. See the section on supering below.

Check for signs of swarming during hive inspections and at other times. If a strong colony has few bees out working on calm sunny days, the colony might be preparing to swarm. If swarm cells are along the bottoms of frames, swarming will occur soon unless changes are made. Remove the swarm cells and correct the conditions stimulating swarming. If only a few queen cells are found on the face of the comb, do not remove them; these are supersedure cells and indicate a missing or failing queen. The usual time for supersedure is also just before a nectar flow so swarming and supersedure can occur together. Supersedure swarms contain one or more virgin queens. The former queen is left behind to be replaced by a queen still developing.

You can prevent supersedure swarming by maintaining a vigorous queen in the colony. This is usually assured by requeening the colony every other year. An old, frail queen is not able to uphold her egg-laying task during the demand for rapid buildup of brood just before the main nectar flow. Workers become eager to replace her with a more efficient queen and begin building a few supersedure cells on the face of the comb. If you discover supersedure cells during hive inspection, allow them to develop. It is better to

TABLE 1 — CAUSES OF SWARMING



allow the bees to replace the queen than to force them to stay with a queen that is not productive. Most likely they will keep building supersedure cells until they succeed in replacing the failing queen.

Supering and Removing Supers

The procedure for supering to obtain the best honey crop depends on the style of honey desired. Styles, listed by ease of production management, are chunk comb honey, extracted honey, and section comb honey. Chunk comb honey production is advisable for beginning beekeepers. Supering instructions for the other styles of honey and special techniques can be found in such books as *How to Keep Bees and Sell Honey*, *The Hive and the Honeybee*, or *ABC and XYZ of Bee Culture*.

Add a super when the nectar flow starts in your area and the bees begin to whiten the tops of the frames with new wax. Super frames should be complete with foundation so the bees can start drawing out the combs immediately. Add a second super to the top when the first is two-thirds full. Add new supers on top of supers already on the hive. Add the third super when the first is nearly full and the second is half full. Reverse the order of the first and second supers and add the third on top. If the third super is being drawn rapidly, put it next to the brood (Fig. 22). Reversing supers keeps the bees working throughout the stack. If more supers are needed, follow the rotation suggested. Do not add supers too fast or add too many at one time. Remove each super as soon as it is completely capped. Add supers sparingly toward the close of nectar flow so there are fewer partially filled supers when the bees quit working.

When a super is completely capped over, move it to the top of the stack and place it on top of an inner cover that has a bee escape in the center hole. It takes about a day to clear the super of bees with this method. The next day the super can be removed from the hive. During the day in hot weather, do not leave on a super containing no bees. Without bees, the combs might melt.

When opening hives and removing supers, be aware of the potential of bees to initiate robbing. To avoid robbing, do not keep hives open for extended periods of time. Always keep supers of honey covered, and do not expose combs, especially those not covered with bees.

Feeding Bees

Early spring and late fall are the most important times to watch for the need to feed. Bees are nearing starvation when no capped honey is in the hives. Bees should have 50 to 60 pounds of stores

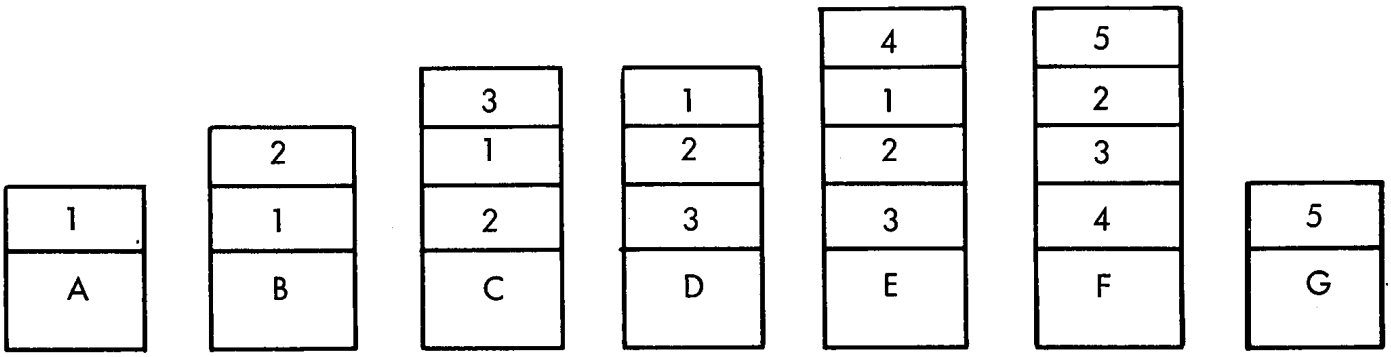


Fig. 22—Sequence of adding and removing supers.

going into winter. If properly wintered, enough should be left to build the colony to full strength in time for the main nectar flow.

The honey crop will be small if bees are still building colony strength during the main nectar flow. This is due to the small workforce and the fact that they must spend most of their time gathering food just to maintain the brood. It takes one cell of honey and one of pollen to rear one bee, and the adults must eat too. Food should be provided if there is an imbalance between brood needs and available food.

There might be a tendency to overfeed bees too early in the spring or too late in the winter in an attempt to prepare them for nectar flow. Bees store syrup as if it were honey and may be stimulated to swarm even if there is not a natural source of nectar. To avoid this, feed bees only the amount they need when they need it. You will learn by experience to judge the condition of stores by hefting the hive. Assume a full deep frame weighs six pounds and full shallow frame weighs three pounds. Never allow stores to drop below 12 to 18 pounds.

The best bee food is ripe honey. Beekeepers often set aside dark, strong flavored, or other low-value honey to feed bees during emergencies. The honey is left in the frames and used to replace empty frames as needed. If you do not have honey reserves, make a syrup from equal volumes of pure cane sugar and water. Bring the water to a boil and remove from the heat. Stir in the sugar until it dissolves.

You can spread dry sugar on the inner cover during warm weather when the bees are flying freely. Make sure water is available when feeding dry sugar. Sugar candy can be used for emergency winter feeding and is made as follows. Add 12 pounds of sugar to a quart of boiling water. Stir well and let simmer for 15 minutes. Add a little salt and a teaspoon of cream of tartar. Let it partially cool, then stir vigorously and pour into dishes. After the candy is set, a dish may be put upside down over the frames holding the cluster.

Honey gathered in late fall might not be ripe and can cause problems for the bees. Wintering bees become loaded with indigestible material from this honey when they cannot get out of the hive to void themselves in flight. They become restless and die in the hive. Feeding 10 pounds of syrup to the colony before brood rearing stops in the fall can help.

No special equipment is needed to feed dry sugar, but put syrup in containers large enough to hold a good amount but not enough for the bees to drown. There are many types of syrup feeders. Some are designed to be placed in the hive; others are for use outside. Outside feeders might be inaccessible to bees during bad weather and can encourage robbing by attracting bees from other hives.

One of the best feeders is a five- or 10-pound friction top pail with about a dozen small nail holes punched near the center of the lid. A large screw top jar may be used as well. Place the feeder lid-down over the hole in the inner cover on the hive body (Fig. 23). Place a super around the feeder and cover with the top lid.

Some beekeepers prefer to use a division board feeder (Fig. 24). The size and shape of a deep frame, it is supported in the hive by top projections like a regular frame. The feeder sides are made of metal, plywood, or a similar material. It can be made watertight by coating the inside with melted paraffin. The top floats on the sur-

Fig. 23—Friction top feeding pail in place.

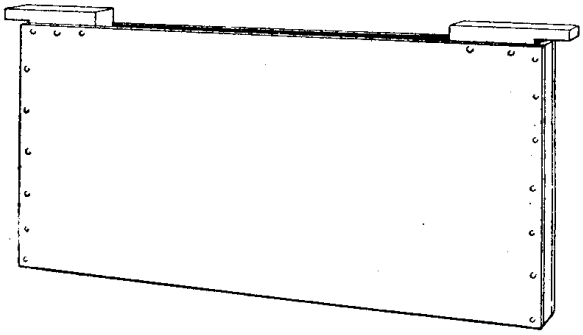


Fig. 24—Division-board feeder to be hung in hive in place of frame.

face of the syrup allowing the bees to enter and feed without drowning. The feeder is hung at one side in the hive and may be left there permanently. If no feeder is available, fill an empty comb with syrup and hang it in the hive.

An adequate supply of pollen is essential for early spring brood rearing. At this time, natural pollen is scarce and poor weather can prevent pollen collection. This is the critical period for colony buildup so you might need to feed a pollen substitute. Make this by mixing one part brewer's yeast, two parts expeller-processed soybean flour, and three parts sugar syrup. Mix these to a paste-like consistency and shape into cakes to be placed over the brood area of the colony. Start with a small cake in late winter, and use larger portions as the brood area increases. Continue to feed freshly prepared pollen substitute until natural pollen becomes available. A pollen substitute may be purchased from supply dealers and is usually better than a homemade mixture.

Types of Honey Production and Packaging

Honey is classified according to its nectar source or the style in which it is sold. You might not have much control over the nectar source, which determines the honey's color and flavor. The three main styles, however, are determined by bee management practices and simply require some advanced planning. These styles are cut comb honey, extracted honey, and section honeycomb.

Cut comb honey is the easiest to produce and the cheapest to package and market. Simply cut chunks of honey-filled comb from the frames. Wrap individual pieces in plastic wrap and they are ready for gifts or sale. The price is not as good as for other styles, but there is usually a ready market. This style is recommended for the beginning beekeeper.

Extracted honey is the liquid after it has been removed from the comb. Professional extracting equipment is available but expensive. Small-scale beekeepers can do the job cheaply by crushing the combs and letting the honey run slowly through strainers. One method is to lay the comb on top of two or four thicknesses of cheesecloth on hardware cloth or hail screen. This is placed over a dish pan or collecting dish. The hail screen supports the mass, and the cheesecloth does the straining. Do this when temperatures are near 90° F so the honey will flow. Specialty products such as honey butter and whipped honey are made from extracted honey.

Section comb honey is the most difficult. It is produced in special square basswood containers. There are four comb sections in a shallow frame. The bees draw out the comb and fill in the cells in these sections. In effect, they package the honey for you. The management technique for this style of honey encourages the bees to swarm and they usually do. A round section adapted for use in standard frames of foundation is now available and has some advantages over the conventional section comb equipment.

Moving Bees

Moving colonies is primarily the concern of migratory beekeepers, but you might need to move yours at some time. Relocating the hive can really upset the colony. Field bees from colonies moved distances less than a mile tend to return to the original location. Move hives far enough to put them into unfamiliar territory. While there is no exact minimum distance, two miles is usually sufficient.

The best time to move bees is about dusk, when most of the bees have returned to the hive. Any time on a cool rainy day is also a good time to move bees provided they are not flying.

Fasten together hive parts using hive staples, lath, steel, or plastic strapping a day or more in advance. In hot weather, use moving screens in place of regular hive covers. Moving screens are similar to inner covers that have had the thin-plywood center replaced with eight-mesh hardware cloth. Screen the entrance closed with a folded piece of window screen or eight-mesh hardware cloth.

When you are ready to load the hives, put on a veil and light a smoker. Smoke the hive entrance well and wait a minute or two before slipping in the entrance screen. Place the hives on the truck or trailer. Arrange them as close together as possible and/or tie them in place to reduce shifting en route. At the new location, put all the hives in place, smoke the entrances well, and remove the entrance screens immediately.

Uniting Colonies

Weak colonies produce little honey and are poor risks for winter. It is better to take your losses in fall rather than spring. Combine weak colonies with moderately strong colonies with good queens. Uniting two weak colonies does not produce one strong colony. Always examine the colonies for signs of disease before combining them.

Kill any queen present in the weak colony. Then place the hive, with the bottom board removed, above a single sheet of newspaper over the top of the stronger colony. Punch a few small slits in the paper to make it easier for the bees to remove the paper. The bees should remove the paper with little fighting as the colonies are united.

Seasonal Management and Activities

Record Keeping

Whether you keep bees for profit or as a hobby, keep records to manage your hives efficiently. They allow you to see if your effort is paying off.

One type of record is a diary in a weatherproof container attached to each hive. In the diary, record: date the colony was established, dates of inspection, date it was requeened, honey yield, occurrence of disease—if any, and other facts which help you manage a particular hive.

Honey plant blooming records help you schedule management practices. Examples of two methods of such record keeping are shown on page 16.

The first style shows the succession of bloom more clearly, while the second style shows the range of dates for which you can expect nectar flow from a particular plant.

Spring Management

Spring management varies from locality to locality and year to year depending on weather conditions and the available nectar

Nectar Flow Records for 19____			
Plant	**1st Bloom**	**Foraging Dates**	**Last Bloom**
White Clover Sourwood Boneset	15 May 25 May 20 Jul	5 Jun to 15 Jul 4 Jul to 28 Sep 25 Aug to 15 Sep	3 Aug 5 Aug 15 Oct
Nectar Flow Records for White Clover			
Year	**1st Bloom**	**Foraging Dates**	**Last Bloom**
19__ 19__	15 May 17 May	5 Jun to 15 Jul 4 Jun to 20 Jul	3 Aug 4 Aug

sources in the area. The following sequence of spring management practices might have to be modified slightly for some areas.

Early Spring (late March to early April)

1. Tilt each hive back and clear the bottom board of dead bees and debris. When finished, replace the entrance reducer.

2. Check for a good egg and brood pattern. This shows the queen is laying well. She should have begun in late February or early March. If the queen is missing or not laying in a good pattern, plan to requeen in April when some nectar is coming into the hive.

3. Check for sufficient stores. The supply should never get below 10 pounds. The bees can exhaust this amount in a week if no nectar is coming in.

Mid-Spring (the period of fruit bloom)

1. Requeen the hives according to your plans.

2. Continue to watch for poor queens in other hives, i.e., spotty or sparse egg laying. Requeen immediately if needed.

3. Provide free access to the hive entrance by removing the entrance reducer and rank plant growth in front of the entrance.

4. As the fruit bloom period progresses, brood rearing might move up into the overwintering super. If so, reverse the hive body and super so the super is on the bottom.

5. If full frames of honey and pollen are next to the brood nest blocking its expansion, rearrange the frames in the brood chamber so an empty frame separates the brood from the food stores. As these frames fill with brood, provide more space in a like manner.

Late Spring (end of fruit bloom to beginning of main nectar flow)

1. Watch for signs of swarming. Prepare empty equipment to hive swarms and increase your numbers of colonies or to provide expansion room.

2. Just before the main nectar flow, rearrange the hive body and super so that the super is again on top.

3. Begin supering for honey production. See the section on supering for instructions.

Fall Management

Fall management prepares the hive for winter. The three main requirements are: 1) a large supply of healthy young bees, 2) an abundant supply of food stores, and 3) sufficient protection from cold and disturbances.

A large cluster of bees is needed to produce and conserve enough heat to survive. If the cluster shrinks in size during winter because many bees die of old age or disease, the rest of the colony might also die because of freezing. Honey is the fuel bees use to generate heat, so an abundant supply is needed for winter. Protect the hives from winds or the bees will use up their honey too fast and might not be able to maintain a living temperature.

Fall management practices to help bees meet satisfactory wintering conditions are:

1. Check that the cluster contains five to 12 pounds of bees, or enough to cover five to 12 frames.

2. Unite small colonies with stronger ones. Leave the extra hive body above the hole in the inner cover to keep wax moths from destroying the comb.

3. Feed the colony fumagillin-treated syrup if Nosema disease is in your area. This disease can reduce the cluster size such that it will die of freezing.

4. If the colony does not have a full hive body and shallow super of honey, or about 50 pounds, feed sugar syrup to make up the shortage. Do this in late September and October.

5. Build a windbreak or move the hives to the protection of a hedge, wall, building, or some natural windbreak.

6. Wrapping the hive with insulation is not recommended in Kentucky. Bees winter as well without it.

7. Before the first frost, insert the entrance reducer. An entrance reducer at this time helps to prevent field mice from entering the hive.

8. Treat for varroa and tracheal mites. Use vegetable shortening or menthol treatments for tracheal mites and Apistan® strips for varroa mites. See the section on diseases.

Winter Management

The main thing to check in winter is that the hives are not damaged by animals or storms. If you provide the proper conditions in the fall, there is no reason to open the hive in winter. Unnecessarily opening only creates problems. It can cause the hive temperature to drop and the temperature inside the cluster to rise. This stimulates brood rearing which might deplete food stores. Cracks created by moving hive parts will not be resealed so the hive will lose some of its insulating ability.

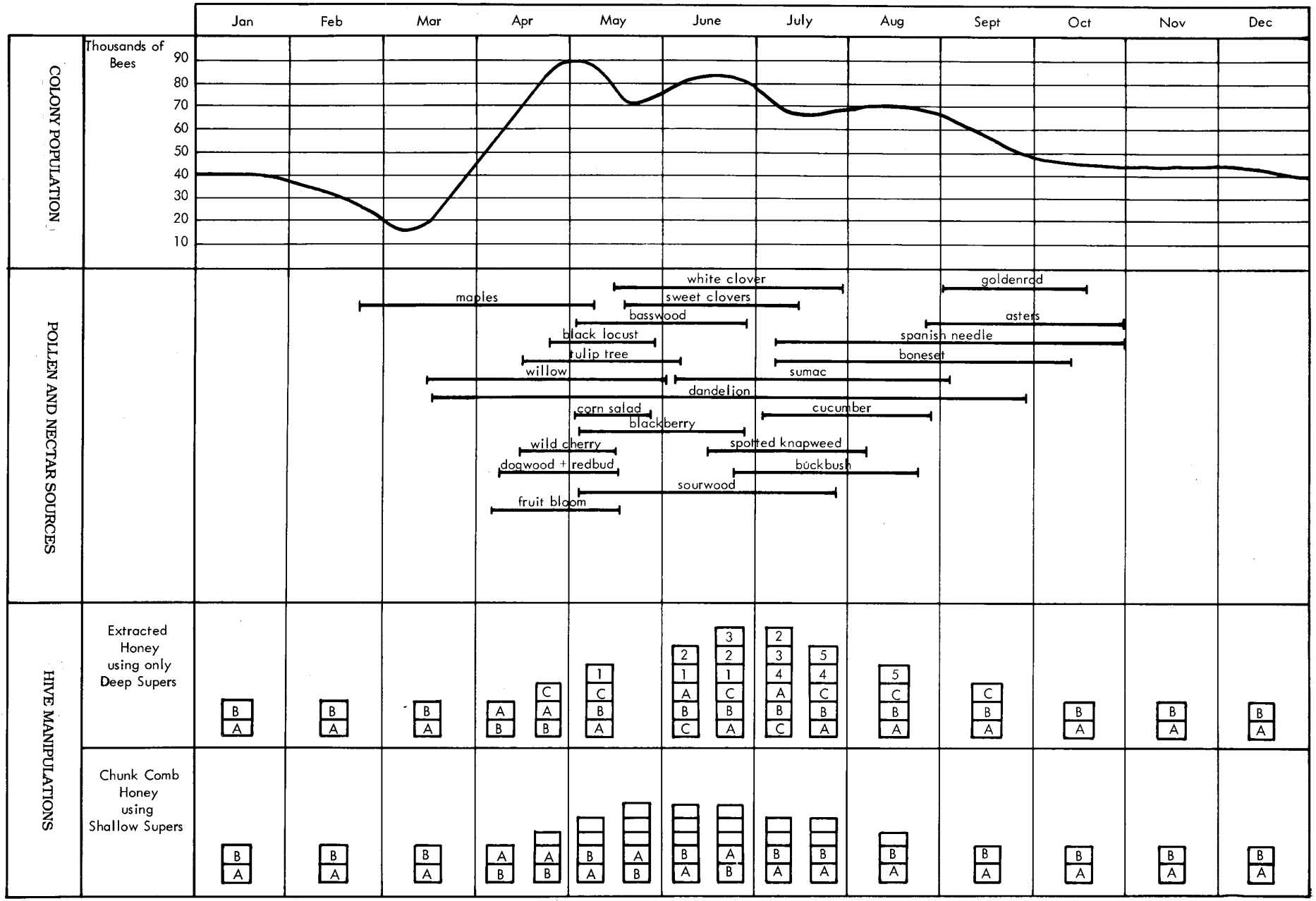

Jan
Feb
Mar
Apr
May
June
July
Aug
Sept
Oct
Nov
Dec
COLONY POPULATION
Thousands of Bees
90
80
70
60
50
40
30
20
10
POLLEN AND NECTAR SOURCES
maples
white clover
sweet clovers
basswood
black locust
tulip tree
willow
dandelion
corn salad
blackberry
wild cherry
dogwood + redbud
fruit bloom
sourwood
goldenrod
asters
spanish needle
boneset
sumac
cucumber
spotted knapweed
buckbush
HIVE MANIPULATIONS
Extracted Honey using only Deep Supers
Chunk Comb Honey using Shallow Supers

TABLE 2—CHARACTERISTICS OF BROOD DISEASES

Disease	American Foulbrood	European Foulbrood	Sacbrood
Causative organism	*Bacillus larvae*	*Bacillus pluton*	Virus
Manner of spread	Contaminated honey	Not definitely known	Not known
Age brood attacked	After cells are capped	4 or 5 days old, before cells are capped	Just after capping
Appearance of capping	Often sunken and perforated	Affected brood mostly uncapped	Sunken caps less noticeable than with AFB, some with two holes
Proportion of brood affected	Usually much	Usually much	Usually little
Larval color	Turn yellow, brown, and finally coffee brown	Yellow; gray; brown	Dirty white to black with the head end darker
Larval consistency	Sticky and elastic	Slimy, nonelastic	Like a sack of water
Odor	Foul, burnt glue smell	Slight to strong sour odor	No odor
Larval position	Lengthwise along lower side of cell	In any position but usually curled at the cell bottom	Lengthwise along the lower side of cell, becomes mummified
Scales	Dark scale glued to cell wall; brittle	Brown scale easily removed; tough and rubbery	Black scale easily removed; brittle
Control	Treat with drugs for prevention and burn infected colonies	Requeening; heavy feeding; feed terramycin	Requeen and strengthen colony
If you suspect disease in your colony, consult with an experienced beekeeper or contact the Department of Entomology, Kentucky State University, Frankfort, KY 40601.			

Enemies of Bees

Like most living things, honeybees can become diseased. The most common bee diseases in the United States are American foulbrood (AFB) and European foulbrood, which affect the brood. Nosema is the most serious ailment of adult bees.

Brood Diseases

In some areas, systematic applications of antibiotic chemicals during spring and fall hive examinations are used to prevent American and European foulbrood (Table 2). Terramycin mixed with sugar has given effective disease control. After checking the brood frames and replacing them, sift the sugar-chemical mixture over the top of the brood frames. Terramycin controls both American and European foulbrood. Although American foulbrood can be cured, present bee laws require that bees infected with AFB be destroyed. The drug is to be used only as a preventive treatment.

Powdered Sugar Treatment

1. Combine one pound of powdered sugar with ¼ cup of animal formula terramycin TM-25.

2. Mix thoroughly by sifting four times with a household flour sifter.

3. Apply ¼ cup of mixture with a sifter to top of brood frames.

4. If your colony is kept in an apiary that has had diseased colonies, treat three to four times at weekly intervals. Otherwise only one application is necessary.

5. Do not apply drugs during a nectar flow. Allow a month between last treatment and nectar flow.

Terramycin can be obtained from bee supply houses listed in bee magazines. Terramycin-sugar mixture costs about 10 cents per treatment.

Extender Patty Treatment

1. Combine 1/3 pound powdered sugar and two tablespoons TM-25 with 1/3 pound vegetable shortening. Mix thoroughly.

2. Place the mixture between two pieces of wax paper and press flat into a patty. The patty must be flat enough to fit between the upper and lower brood chambers. The extender patty can be used in March and October and eliminates the three weekly treatments of terramycin and powdered sugar.

Nosema

Nosema, a disease caused by the protozoan *Nosema apis*, attacks the true stomach and intestines of adult bees. It is widespread and especially troublesome in colder areas where winter is long with only a few flight days. The disease is most common during periods of cold damp weather in late winter and early spring. Sick bees with swollen abdomens crawl about quickly in front of the hive, climb grass blades, and try to fly. Often this disease clears up as the nectar flow begins, but its cure and prevention can be brought about by feeding the bees syrup containing the antibiotic fumagillin (Fumidil-B). Prepare the syrup by bringing five to six gallons of water almost to a boil. Remove from the heat and add ½ gram of fumagillin. Stir until the fumagillin is dissolved. Then add 10 pounds of sugar and stir to make a clear syrup. The syrup is fed in the fall or in both fall and spring. DO NOT FEED MEDICATED SYRUP DURING OR RIGHT BEFORE NECTAR FLOW.

Paralysis

The presence of trembling bees with shrunken abdomens in front of or in the hive is an indication of paralysis. These bees resist being driven off by their healthy sisters. Sick bees might also be weak, dark-colored, and shiny. There is no sure cure for this disease, but it does not occur often. One treatment is to requeen the colony if the problem persists. Another treatment is to exchange the colony's position with that of a strong colony.

Tracheal Mite

The mite, *Acarapis woodi*, is a serious and growing problem for beekeepers. The microscopic mite clogs the breathing tubes of adult bees, blocks oxygen flow, and eventually kills them. Also called acarine disease, this condition affects flight efficiency and results in a large number of crawling bees unable to fly. The inability of bees to fly means a loss of field bees and lack of food in the colony. Another symptom is the abnormal "dislocated" position of the wings of walking bees. The life-span of these infected bees is shortened.

High levels of colony infestations can cause significant economic damage, decreased honey and brood production, increased winter deaths of individual bees, and reduced spring buildup of colonies. Acarine disease could persist in the colony for years causing little damage but when combined with other diseases and unfavorable conditions, the disease increases the mortality of colonies.

Menthol pellets provide control of tracheal mites. A screen package containing two ounces of menthol is placed in each hive in the apiary where tracheal mites are found. Treatments should be placed on the bottom board during hot weather (>80°F) and on the top bars when maximum daily temperatures are cooler than 60°F outdoors. Mite control with menthol is not as effective during cool or cold winter weather. To prevent honey contamination, treat before honey production begins in the spring or after surplus honey is removed in the fall.

An alternative to the menthol treatment is a vegetable shortening/powdered sugar treatment. One part vegetable shortening is mixed with two parts powdered sugar. One cup of this mixture is flattened between two pieces of wax. The patty must be flat enough to fit between the upper and lower brood chambers. If no nectar flow is occurring, feed colonies a light syrup (one part sugar to three parts water) to stimulate heavy brood production. A large population of young bees is needed for successful wintering.

Lines of bees with resistance to the tracheal mite are commercially available. Hives can be requeened with mite-resistant queens. Mite resistance means mites develop more slowly in these bees, but the bees are not immune. Even these resistant bees can succumb to tracheal mites if no other management practices are used.

Varroa Mite

The mite, *Varroa jacobsoni*, is one of the most serious pests of the honeybee. It is a parasite that attacks both brood and adults. Unless special measures are taken to search for the mite, early detection is unlikely. The mites develop in sealed brood cells. Bees emerging from infested cells are often deformed with missing legs or wings. Heavy infestation of several mites per cell kills the developing pupae.

Adult female mites are reddish brown to dark brown, oval and flattened in shape, approximately 1/25-inch long and can be seen easily with the unaided eye. Adult male mites are much smaller and lighter. Their flattened body allows them to hide between the bee's abdominal segments or between body regions where they feed on the bee's blood.

Female mites enter honeybee brood cells shortly before cells are capped, feed on the larvae, and lay eggs. Adult mites develop in six to 10 days and mate in the cells before emerging with the bee. Male mites die soon after mating. During spring and summer most mites are found on the brood (especially drone brood). In late fall and winter most mites are found on the adult workers.

Unchecked infestations can kill colonies in as few as three years. Colonies infested with varroa mites can be treated by means of Apistan® strips. These strips are available from most beekeeping supply distributors. Remove honey supers and place two Apistan® strips in the brood area of the hive. Follow label directions carefully.

The bee louse, *Bracula coeca*, resembles the varroa mite in size and color. However, the bee louse is an insect with six legs which extend to the side. The varroa mite has eight legs that extend forward. The bee louse never builds up to high enough numbers to cause problems.

Other Pests

Wax moths get in hives in which they can cause damage because the colony is not strong enough to protect the comb or too many empty supers are on the hive. Wax moths also damage unprotected combs in storage. Fumigation with paradichlorobenzene

protects combs in storage from wax moths. Combs containing honey must not be fumigated because paradichlorobenzene is readily absorbed by honey.

When fumigating with paradichlorobenzene, stack supers in storage as tightly as possible. No more than five full-depth or 10 half-depth supers should be in a stack. For long periods of storage, seal the cracks between the supers with tape, particularly the bottom of the stack as the gas is heavier than air. Place six tablespoons of crystals on a piece of cardboard on the frames of the top super and replace the cover. Periodically examine the crystals and replace if no longer present. Air out fumigated combs a few hours before returning them to the colonies.

When bee colonies are bothered by wax moths or other insect pests, such as wasps or ants, it usually means the colony is weak. Building up colony strength allows the bees to repel these pests.

Skunks might snoop around a hive at night and can weaken a colony by eating bees that come out to investigate the disturbance. If the problem is bad, trapping or poisoning the skunks is necessary.

Mice might nest in combs in winter storage. They also enter hives in late fall and build nests. Colonies can be protected by placing 3/8-inch wire mesh across the entrance. The mesh does not hamper movement of bees in and out of the hive.

Bee Poisoning

An important consideration when locating a colony is the possibility of poisoning by pesticide applications. This is especially true when colonies are located near cultivated crops. The best rule of thumb is to establish and maintain communication with nearby farmers so you will be notified before pesticide applications. The key to protecting bee colonies is prevention, usually possible through cooperation between the beekeeper and those who might apply pesticides.

Cooperative growers concerned about preventing bee losses can follow the these rules: (1) do not apply insecticides to open blossoms; (2) spray preferably in the late afternoon or early in the morning as your second choice—not in the middle of the day when bees are flying; (3) use sprays instead of dusts for a given insecticide; (4) give advanced warning of the use of insecticides so hives can be moved out of the flight range of the danger; (5) apply proper dosages and follow pesticide label directions. Orchardists can reduce bee losses by mowing or clipping blossoms from cover crops before pesticide applications. Beekeepers should be familiar with commonly used insecticides and their toxicity to bees. Beekeepers also should know as much as possible about the relationship of their bees to nectar and pollen plants in the area.

A noticeable symptom of poisoning is a large number of dead bees near the hive. If many bees are killed in the field, there simply might be a lack of bees in the hive. Before bees actually die from most pesticides, they might behave erratically and unusually or become stupefied and paralyzed.

Beekeeping References

Bee and Bee Equipment Supply Houses

Dadant and Sons, Hamilton, IL
Walter T. Kelley Co., Clarkson, KY
A.I. Root Co., Medina, OH
Superior Honey Co., Southgate, CA; Ogden, UT; Denver, CO
Montgomery Ward Co.
Sears Roebuck Co.

Books

ABC and XYZ of Bee Culture, A.I. Root Co., Medina, OH
First Book of Bees, Franklin Watts, Inc., New York, NY
First Lessons in Beekeeping, C.P. Dadant, American Bee Journal, Hamilton, IL
500 Answers to Bee Questions, A.I. Root Co., Medina, OH
How to Keep Bees and Sell Honey, Walter T. Kelley, Clarkson, KY
Starting Right with Bees, A.I. Root Co., Medina, OH
Honey Plants Manual, A.I. Root Co., Medina, OH
The Hive and the Honeybee, C.P. Dadant, Hamilton, IL

Periodicals

Bee World, Woodside House, Chalfont Heights, Gerrands Cross, Bucks, England
Journal of Apicultural Research, Woodside House, Chalfont Heights, Gerrands Cross, Bucks, England
Gleanings in Bee Culture, A.I. Root Co., Medina, OH
American Bee Journal, Hamilton, IL
Canadian Bee Journal, Port Hope, Ontario, Canada
The Kentucky Bee Line, Kentucky Beekeepers' Association, 123 Adams St., Berea, KY 40403

Services Available

Kentucky State University, Frankfort, KY 40601
Department of Entomology, University of Kentucky, Lexington, KY 40546
Kentucky Department of Agriculture, Frankfort, KY 40601
Kentucky State Beekeepers' Association, 123 Adams St., Berea, KY 40403
Bee Breeding Investigations Laboratory, Room 240, Agricultural Center, Louisiana State University, Baton Rouge, LA 70803
Bee Disease Investigations Laboratory, Building A, Agricultural Research Center, Beltsville, MD 20705
Bee Management Investigations Laboratory, Room 436, Russell Laboratories, University of Wisconsin, Madison, WI 53706

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