PURDUE
EXTENSION

4-H-593-W

4-H Beekeeping

Advanced Beekeeping Methods

18 USC 707

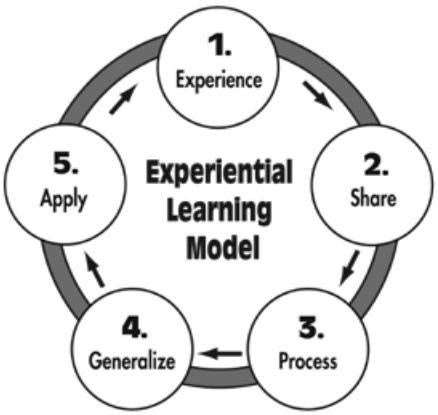
4-H Beekeeping, Division III: Advanced Beekeeping Methods

The 4-H beekeeping project is intended to help you learn about bees and how to be a beekeeper. Beekeeping offers many hands-on educational experiences, from learning about bees and honey plants, to learning to raise bees and produce honey, to learning how to market your honey.

If you have completed the 4-H beekeeping manuals, *Division I, Understanding the Honey Bee,* and *Division II, Working with Honey Bees,* you are now experienced and knowledgeable enough to study more advanced topics. These may include increasing the number of your honey bee colonies, increasing honey production, producing special kinds of honey, and learning more about the bee societies. If you have not studied the Division I and II beekeeping manuals, you should review them and start slowly in *Advanced Beekeeping*.

Note to Parents and Volunteer Leaders

The 4-H beekeeping project helps youth learn about raising honey bees. Beekeeping offers many exciting educational experiences, from learning about bees and honey plants to learning to raise bees to make and sell honey. The *4-H Beekeeping Helper's Guide* (4-H-576-W) has information about youth development stages, experiential learning, and other resources that might be useful. The learning experiences in this manual have been planned to initiate "experience centered" activities. Youth are encouraged to take responsibility for their beekeeping projects. They can enhance their learning by consulting resources on the Internet, at school, and at the library, or by talking to someone who raises bees.



Experiential learning distinguishes 4-H youth development education from many formal educational methods. Activities are designed so youth *experience* a learning activity, *share* what they did, think about their experience (*process*), *generalize* what they learned to other situations, and then think about how they can *apply* what they learned in their lives (now or in the future). You can help guide youth through the experiential learning steps to enhance their learning.

Purpose

Division III Beekeeping is intended to help youth learn many things, including
- how to increase the number of their honey bee colonies;
- how to increase honey production, producing special kinds of honey;
- more about the bee societies;
- how to compile beekeeping records;
- how to present the results of their work to others; and
- how to develop inquiring minds — the habit of asking questions and searching for answers.

Authors: Greg Hunt and Natalie Carroll
Contributor: Krispn Given
Reviewer: Larry Segerlind
Photos: Greg Hunt and Krispn Given

Advanced Beekeeping Methods

Introduction

When you feel confident in your ability to maintain a beehive throughout the year and have been successful in producing surplus honey, you are ready to undertake more complex and difficult projects with your bees. In *Advanced Beekeeping*, you will continue to develop your skills as a beekeeper. Good beekeepers not only care for their colonies, but also manage them to increase honey production.

Your goals for advanced beekeeping should be

- keeping strong, populous colonies with young queens,
- continuing to improve your understanding of the ways of bees, and
- experimentation.

As your beekeeping experience increases, your ability to work more quickly and competently also increases. You will be able to add new hives to your small original apiary until it contains the maximum number of hives that you can care for. Good beekeepers know what their maximum apiary size should be and do not try to overextend themselves. To determine the number of hives you can tend, you will need to consider a variety of factors: time, expense, space considerations, your own physical condition, local climate, etc. The maximum number of hives differs from beekeeper to beekeeper. For a hobby, the maximum may be two hives; for a young farmer, it could be 200.

To achieve the greatest amount of honey production, you must realize that your beehive is a dynamic, changeable system with much potential for growth. Be alert to the apiary operations that can be improved and consider experiments that will help you understand more about your bees. As you learn more, you will be able to help your bees produce more honey.

Although you have had some practical experience in beekeeping, you should not neglect the help that other beekeepers can still give you. As you continue this project, the advice of more experienced people will be as valuable as it was the first time you watched a beehive being opened. Continue to read all you can and to take your questions to your beekeeping advisor, local bee inspector, and local and state associations.

In the *Advanced Beekeeping* project, you are in charge. No longer will you be told what to do and when to do it. No longer will you be asked specific questions to show your understanding of a concept or procedure. Now you are basically on your own. You choose your activity, do it, and when you believe you have mastered it, move on to another.

Projects

The project suggestions given later in this manual are just that: suggestions. They are intended to develop your beekeeping skills. You can pursue any beekeeping project of your own design. Choose one that fits your own interests and the needs of your bees. See the list under Project Suggestions for ideas. Select a project that you are interested in and read about it. If you are still interested, begin work on the project. Undertake as many activities as you think you will be able to complete, but do at least two projects each year. Keep a notebook with an up-to-date description of your work. With the aid of a beekeeping diary, you can write a detailed report explaining your project from start to finish. Consider taking photographs, making drawings, or using other ways of adding to the explanation of your activities.

Use the Resources section to find sources of information. Many projects may be done using the **Scientific Method** (page 34). Following the steps listed for the scientific method helps to organize your thoughts and experiment. This makes for a nice comparative project. Make your own data sheet following the five steps listed.

An **interactive demonstration** (page 35) is a good way to show others what you have learned and to interest them in beekeeping. Read the guidelines in this manual for ideas about how to present and evaluate your demonstration. Ask your county Extension educator about doing an interactive demonstration at the Indiana State Fair, if you are interested in doing that.

Resources

There are two books that are recommended for the serious beekeeper, *Honey Bee Biology and Beekeeping* and *The Hive and the Honey Bee*. These books contain a lot of information about bee biology and products of the hive, including most of the information a beekeeper would ever need. Therefore, it is a good idea to purchase a copy of one of these books or to make certain that your local library has one. *Honey Bee Biology and Beekeeping* is the better one, but is more expensive. See the Resources section of this booklet for

ordering information and for information on subscribing to a beekeeper trade journal.

Record Sheets

Keeping accurate records is important. Records help you remember what you did and evaluate the success of your work. They also help you keep track of how much time and money you are spending on your beekeeping project. The record sheets given in the manual may be copied, or you can use them as guides to create your own record sheets.

Managing Honey Bee Colonies

Choosing a Good Apiary Site

The site you choose for your apiary should have plenty of floral sources within two miles of your hives. In much of the Midwest, wild clover will be a major source of nectar for your bees. Any place that has a mixture of trees and unplowed fields is good. Ideally, there should be water available within a quarter mile of the hives. Bees can collect water from dew and puddles, but during a hot, dry summer, even dew may be scarce, and bees need water to air-condition the hive and to dilute royal jelly for feeding brood. The apiary should be accessible at all times of the year. It is best if the hives are placed on hard, dry ground that you can drive up to in a truck. It is advisable to place the bees near some trees that block the wind from the west and on a slight hill to avoid frost pockets. A protected site with good air drainage will improve the chances that your bees will survive over the winter.

Increasing the Number of Colonies

You can increase your colonies by buying nucs, installing package bees, or dividing your existing colonies.

Buying nucs

Purchasing nucleus hives or "nucs" is a very good way to increase your colonies. The nuc is a small hive of three to five frames containing comb with bees, brood, honey, and pollen. A nuc will build up more quickly than a package of bees that is installed on foundation, because there already are some capped brood and empty cells where the queen can lay eggs. Nucs purchased locally are more likely to have queens that produce bees adapted to your local conditions. Ask at beekeeper meetings or look on the Internet for beekeepers that sell nucs or local queens. Usually, you will need to supply the brood box and enough frames with foundation or comb to fill out the box.

Installing Packages

Sometimes you cannot find a provider of nucs or they are not available early in the year when you want to get your bees. In this case, buying package bees is a good option. Package bees are produced in southern states early in the year for shipment up north. They can be purchased from a supplier and shipped to you directly, or you can make arrangements with someone who is planning to bring a truckload of packages to your area.

Removing the queen cage

1. Order a 2- to 3-pound package of bees with a marked queen to arrive at a specified date. Order early (preferably by January), because some years they sell out. Packages can usually be installed in the Midwest about April 1.

2. Prepare all of your equipment before your bees arrive. For each colony, you will need the following:

    a. Hive stand to keep the bottom off the ground

    b. Two deep brood boxes with ten frames of foundation each (or 9 to 10 frames with comb)

    c. Bottom board

    d. Entrance reducer

    e. Inner cover

    f. Two supers for the honey flow

    g. Cover

    h. A way to feed the bees (A "friction pail" or gallon jar with small holes in the lid both work well.)

    i. Division board feeders (These can be used with floats to keep the bees from drowning. Entrance, or "Boardman," feeders are convenient, but don't work well in temperatures below 40°F.)

Shaking the bees onto the hive

3. When the package arrives at the post office, check to make sure the bottom is not covered with dead bees. If there are 2 to 3 inches of dead bees, notify the shipper and ask for compensation. Keep the package in a dark place at about 50° to 70°F. Spray with 1:1 sugar syrup, but do not soak the bees too much. If you need to wait a day or two before installation, spray with sugar syrup twice a day.

    Install the package as soon as possible. Just before dusk is ideal. Packages can be installed at other times of the day if it is raining or cool (45°F or less). Installing in the

evening keeps the bees from leaving the hive and drifting into others. If you only have one hive, this is not important. If installing during the day, block the entrance with some grass for an hour to keep the bees in the hive, otherwise the bees will tend to drift into the most visible hive (usually the bees fly into the one on the end). Remove the grass after a few hours or the next morning. Spraying the bees with 1:1 sugar syrup right before shaking them into the box can also help keep them from flying. Installation steps:


Introducing the queen in the cage

a. It usually is not necessary to use smoke when installing a package, but it is a good idea to have a smoker lit. It may encourage them to go down into the box.

b. Pry out the syrup can with your hive tool and set it aside.

c. Remove the queen cage and put her in your pocket.

d. Jar the package sharply to knock the bees down to the bottom. Turn it over and shake it vigorously from side to side to get the bees into the box. You may need smoke to encourage the bees to go down between the frames.

e. Let the bees release the queen by eating the candy. Remove the cork from the candy and put a small hole in it with a frame nail (being careful not to stab the queen). Then, position the cage at an angle between the middle frames with the screen facing down so the bees can feed the queen. It is a good idea to put the candy end of the cage at the bottom, just in case it gets wet. This prevents it from flowing onto the queen.

4. Feeding the bees after installing the package is very important. Your colony will decline in population until the new brood hatches and the queen needs comb to lay eggs in. Feeding will allow them to draw out the comb from the foundation. Feed the bees with a gallon jar of 1:1 sugar syrup (at least 50 to 60 percent sugar by volume) that is inverted over the hole in the inner cover and has about six small holes in the lid so the bees can feed on it. In cold weather, it might help if the first two gallons of syrup contain the medication fumagillin, which is sold as a powder called Fumadil-B. This will prevent dysentery

(Nosema). Place the feeder jar over the inner cover hole, leaving a space for bees to come out. Cover the jar with an empty hive body. Check the feeder jar regularly and refill it whenever it is empty. You may need about 5 to 7 gallons of 1:1 sugar syrup per package if installing the package onto foundation. If you are installing the package onto comb, much less syrup will be needed. It is also possible to feed the hive with a division board feeder or Boardman feeder.

5. Check the feeder the next day to make sure your bees have consumed some syrup. If the bees are not clustered in the middle, rearrange the empty frames so that the bees are in the middle.

6. Check the queen in three days. If she is still in the cage, make sure the bees are not biting the cage. It will be easy to push them aside with a finger unless they have latched onto the cage with their mandibles. Then, pry off the screen and allow the queen to walk between the frames. If the bees are latched onto the cage, do not release her, because they will kill her. In this case, you may have another queen in the colony, or it may just require more time for the introduction. If the queen was released by the bees already, check for eggs in the bottom of the comb by tilting the cells up to the light. If there are no eggs and no queen, you may need to order a new one. But it is also possible that she just hasn't laid any eggs yet because she is too young or because there are no cells to lay them in, and you just can't find her!

7. Check the bees one week after installing the package. Always carefully remove an outer frame first to avoid crushing the queen. Look for drawn comb containing eggs. If there are no eggs, search for the queen. If you cannot find her you will need to buy a replacement queen.

8. Inspect the bees every 7 to 10 days to make sure there are eggs and a queen. Observe the expansion of the brood nest, but do not disrupt the nest by rearranging the frames. Replace the frames in roughly the same configuration.

9. When all of the comb is drawn from the foundation in the first box, or at least started by the bees, add a second deep box. You can take one or two outer frames of drawn comb that have little or no brood from the first box and place them toward the center of the upper box to encourage the bees to move up and draw out the foundation and expand the nest.

Bottle feeder

Division board feeder

10. Watch. Give the bees new boxes as soon as they fill up the old ones. When adding supers that contain foundation, place them directly above the brood nest even if you have one super of drawn comb and honey in place already. This will encourage them to draw it out. Supers with foundation should have ten frames; those with comb can have 8 to 9 frames if properly spaced.

Splitting Colonies

There are many ways to divide colonies. Two examples are given below. You need to complete the following preparations before using either method.

Strong hive ready to split!

- Choose strong colonies to divide. The best time is 4 to 6 weeks before the time swarming usually occurs. This is early to mid-April for most Midwestern states.
- Be sure to use enough smoke.
- Ideally, the colony should have brood on 8 to 10 frames or more.
- Arrange for a new queen to be delivered either the day before you want to divide the colony or the same day that you will divide the colony. She will be shipped in a cage with candy and worker "attendants." If the queen of the strong colony is more than a year old, you may want to order two queens and replace the older queen with a new one. If necessary, a queen can be kept in the cage with the attendants for several days to a week in a location that is 65–70°F. Give them a tiny droplet of water with your finger once or twice a day on the screen, but don't let them get wet.
- Have your equipment ready for another colony. You will need the following items:
    - Another hive stand
    - A bottom board
    - Top and inner covers
    - Two deep hive bodies with combs or frames with foundation
    - A feeder is a good idea if there is no nectar coming in from the flowers or you are adding foundation instead of drawn comb (use a division board feeder or gallon jar with a few nail holes in the lid and 1:1 sugar syrup).
    - An empty, deep hive body to enclose the feeder

For Method 2 (below), you will also need a double screen and a queen excluder (if you are not taking the time to find the queen).

1. Simple Divide Method

Four days before the queen you ordered is expected to be delivered, you will want to open the hive using your smoker and divide the brood up equally between two boxes of the existing hive. If you find the queen, put her in the bottom box or put her in a queen cage while you prepare to remove the top box and move frames around. This is the safest way to avoid hurting her. If the queen was not seen, you could put a queen excluder between the boxes. The presence of eggs four days later will tell you where the queen is.

Splitting a colony with three brood chambers

When the divide is made, remove the queenless box to a new location and introduce a queen the next day. To make an even split, it is best to move the divide at least a mile away to prevent all the foragers from returning to the original location, but this may be impractical. If placing the divide in the same apiary, put all of the oldest brood (capped brood about to emerge as adults) and one frame of very young (larvae in uncapped cells) into the upper box that you are going to remove. You can tell if brood is nearing the time of emergence by uncapping some cells and looking for older pupae. It is also a good idea to make sure both boxes contain pollen and honey. You can also put extra brood into the new hive from other colonies later. The new adult bees will help make up for the loss of foragers that will return to the original hive. You can introduce the new queen with the candy cage 12 to 24 hours after you make the divide. If you are requeening the other hive, be sure to wait 12 to 24 hours after de-queening before introducing the new queen.

2. Double-Screen Method

This method is not commonly used. It is similar to the simple divide and can be used for making splits or for making up nucs. The double screen fits over the brood chamber of the old hive and has a slot that provides an upper entrance for the bees. It allows heat and the hive's odor to be transmitted to the upper part. The heat from the lower box helps to keep the brood warm in the upper box. The double screen does not permit queen pheromone to pass to the queenless box, because the bees cannot touch each other, so the bees in the queenless box are soon ready to accept a queen. If the upper hive does not accept the queen, the screen can be removed and the hive can be merged again with no fighting, because the bees still share a common colony odor. With this method

Double screen on top of a hive—The back is open to make an upper entrance.

you can make up many nucs or splits, because you do not have to find the queen. When you go back to inspect it later, the queenless box will probably be buzzing more and will not have eggs.

Double screens are frames that have a screen on each side and that fit over the brood box. They can be purchased or made. Use a double screen that has movable pieces of wood to create an upper entrance. You also can make your own double screen by stapling window screen over both sides of the hole in an inner cover and making a notch in the side of the inner cover to provide an entrance for the bees in the top box.

Choose a strong hive and decide which brood frames you want to move to the top box to make the nuc or split. Use one or two frames of young, uncapped brood and most of the frames of sealed brood that are about to emerge as adults.

Inspect the frames for brood and honey, and decide which ones you want to go in the upper box. It is convenient to bring an empty box to set frames in, or you can just lean them on end against the hive. Replace the frames that you removed from the bottom box with frames from the top box. You can also temporarily add a third brood box and replace frames you move with new frames of comb or foundation. If using frames with foundation, place them between frames containing comb that do not contain much brood. Try to keep the brood in the center of the nest.

Then, place a double screen over the bottom brood chamber and put the box containing older brood, honey, and pollen above it. Or, if you happened to find the queen, just put the frames of brood in the upper box, put the queen in the lower box and place the double screen in between the top box and the original brood chamber. Make sure that the upper box has an entrance, and face it opposite the direction of the lower entrance.

Introduce a queen to the queenless box 1-4 days after the brood chambers are separated by the double screen. It takes three days for an egg to hatch, so if you do not know where the queen is in the beginning you will know which box is queenless in 3–4 days (the one without eggs).

Check the box with the new queen within a week after introducing her. If the queen was accepted, it can be moved it to a new location with a new bottom board and covers. If it needs more bees, you can shake some into it from the bottom box, but be careful you do not shake the old queen into it!

Taking Care of Your Queens

The key to having productive colonies is to always have vigorous queens in disease- and mite-free colonies. Young queens are productive egg layers and are much less likely to swarm. It is a good idea to check all of your hives at least briefly every 10 days, but you should at least check them during critical times, like early spring, just after harvest when treating for mites, and before winter. Check to make sure there are eggs and a good laying pattern — lots of brood in the combs, not a scattered brood pattern. Requeening once a year will insure that you always have young queens. Many beekeepers leave the queen in for two seasons if she is still laying a good brood pattern the second season, but they run the risk that she will begin to fail during the colder months. It is good to have marked queens so that you will have an idea of how old she is and where she came from.

Tagged queen laying an egg

Marking Queens

If you have a supersedure queen, you can mark the queen yourself with just a little practice. *(Supersedure – replacement of a reigning queen by her workers)* Having a marked queen will make her easier to find if you want to replace her and will help to avoid hurting her while you work the hive. If you later find an unmarked queen, you will know she was superceded. To mark her, catch the queen as she walks on the comb by grabbing her wings. Don't be afraid to hold her in your hand. She will not sting you. Queens only sting other queens! Pin her against your clothes and hold her gently but firmly on either side of the thorax between your thumb and forefinger. Have an open bottle of enamel paint (e.g., Testor's) and an open queen cage ready. Use the stem of a grass blade to put a small spot of paint on her thorax, rubbing it into the hairs. Be careful not to use too much or to get paint on other parts of her body, like the eyes and antennae. An easier way is to use enamel-paint marking pens or special queen marking cages. Marking pens can be found at hobby stores or in certain bee supply catalogs. Let the queen dry off for about five minutes in a queen cage before releasing her back into the colony so the workers do not remove the paint. Plastic roller cages are convenient because they have a hinge and large opening. Clipping off the tip of one of her front wings is an option that a few beekeepers use to prevent her from flying away with a swarm. That way, if the colony swarms, the queen may be lost in the grass, but the bees will return to the hive where they will have a new queen. However, they may still swarm again with a virgin queen if you do not relieve the crowding of the brood nest. **Warning:** Make sure she is a mated queen before

A marked queen is easy to spot.

Queen in a roller cage

you clip her wing! If you clip a virgin queen's wing, she cannot fly out and mate.

Young queens are more readily accepted by bees than older queens. Also, queens are more likely to be accepted in small colonies and it is easier to find the old queen to remove her in a small hive than it is in a hive with lots of bees. Therefore, it is easier to requeen in the spring because that is when the colony population is lowest. But there are several advantages to requeening during the summer in northern states. Northern-bred queens may be better adapted to your conditions, and these queens are only available in the summer. For example, someone raising their own queens in the Midwest may be able to have new queens by about the first of June. At this time, it is more likely that there will be good weather for mating queens than earlier. There should be plenty of drones for the queens to mate with as the strong colonies prepare for swarming. Finally, introducing queens during the summer can also insure that you have young queens that are likely to start laying eggs earlier in the year the following spring. Also, young queens are less likely to swarm or be superceded than old queens. If you are trying to maximize honey production, you may want to wait until just after the honey harvest to requeen, or you may want to do it gradually over the summer.

Requeening Methods

A number of requeening methods are covered below. The first step in replacing the queen is to find and kill the old queen. If you are only requeening some of your colonies, replace queens that are no longer laying large patches of brood or ones that you know are old or never produced big colonies. The usual method of killing a queen is to pinch her head. **Do not try to introduce a new queen until the old queen has been out of the colony for at least 12-24 hours.**

In some cases, you can wait longer. Do not wait more than four days, however, if at all possible. The simplest way to introduce a queen into a queenless hive can also be a little risky. If a queen is young and laying eggs, it is often possible to just place her onto a frame of bees and watch as the bees accept her. If they start surrounding her and climbing all over her, it is a sign that they are going to kill her. This is referred to as "balling" behavior.

1. Candy Cage

This is the most common method used to introduce a new queen. The introduction is done as was described for installing package. Queens are usually shipped in candy

Queen and attendants in a candy cage—The candy is put at one end.

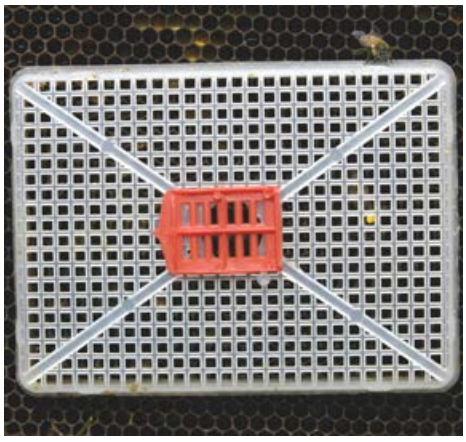
cages. You can make up your own queen cages and candy if you are raising queens. Make the candy by mixing high-fructose clear corn syrup or honey with powdered sugar. It takes a surprising amount of powdered sugar. The candy must be soft but firm. If it is too soft, it will melt in the heat of the hive and can kill the queen by covering her. Put a piece of wax paper between the candy and the screen of the cage to keep it from drying out, and then staple the screen on. The hole in the non-candy end of the cage is sealed with a cork or piece of wood.

2. Nucs
Since queens are more easily accepted into small colonies, one method of requeening is to make up small nucs to introduce the new queens into. A nuc can also be used for introducing virgin queens and queen cells that you find in your other colonies. It then serves as a mating nuc as the queen flies out and mates. Once the queen is accepted and laying, combine the nuc with a larger colony that you made queenless one to two days before merging them.


A small hive, or nuc

3. The Newspaper Method
Perhaps the safest way to merge colonies is to put a sheet of newspaper between them. This allows time for the two boxes of bees to acquire the same colony odor, which prevents fighting. To do this with a nuc, first place the frames from the nuc into a deep hive body. Put one sheet of newspaper over the open hive you are going to merge it with and place it on top. Make some slits in the newspaper with your hive tool so that the bees can chew their way through it more quickly.

4. Push-In Cage
Make a rectangular 3-by-5-inch cage to push into the comb with the queen underneath. It should be made out of 8mesh hardware cloth (eight openings per inch). This method is often used when introducing artificially inseminated queens. When done properly, it is the safest method.


Queen under a push-in cage

You can also buy plastic push-in cages that work a little better, because the bees are less likely to chew around the edges and enter the cage. The advantage of a push-in cage is that it allows the queen to begin laying eggs before she is released. Shake the bees off of comb that is fairly dark (they are stronger). Place the cage in an area with a little open nectar or honey and (preferably) over a small patch of emerging brood so the bees that emerge will tend her. It is not necessary

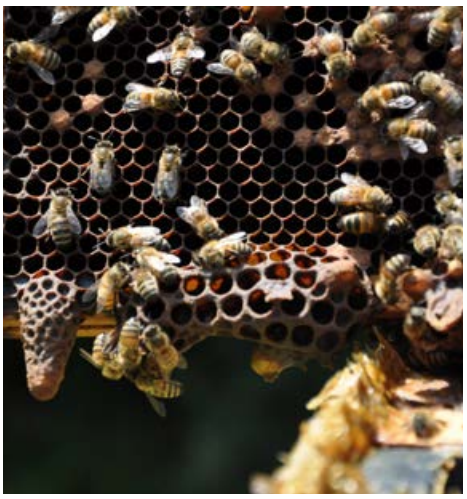
that the cage is over brood, but there should be a few cells of honey. You MUST make sure that the push-in cage is pressed in firmly. Check the cage in 3 to 5 days to make sure the bees have not chewed underneath. If they are beginning to do this, you must move the cage. Once the queen is laying eggs or you are satisfied the bees are not biting the cage, you may release the queen directly. **Hint:** If the bees have their mandibles clamped onto the cage, it will be difficult to dislodge them with your finger. Never release a queen if they are biting the cage.

5. Virgin Queens

Virgin queens can be introduced the same way as other queens, but they are sometimes more difficult because they are less attractive to the bees. They also tend to run around and are harder to catch. They may fly away during the process but will probably return to the hive if they do. A new queen will take 5 to 10 days to take her first mating flight, and another week after that before she is laying lots of eggs. If she doesn't mate in 14 days, she is getting too old to properly mate. You have to expect a two-week break in brood rearing with a virgin queen. For this reason, you may want to consider introducing her to a mating nuc before killing the old queen and introducing her to the main hive. Another good alternative is to introduce her ABOVE the old hive. Take a notched inner cover and place it with the notch up and facing the back of the hive to provide a second entrance. Take two frames of brood and bees and one frame of honey (but not the queen) and put them in a deep box above the inner cover. Seal the hole in the inner cover with a double screen. After 24 hours, introduce the virgin in the top box. In two weeks, check for eggs and brood. You can then use the newspaper method to merge the two colonies, or you can just remove the double screen and allow them to merge. The new queen should be the one that survives, but it is safest if you remove the old queen first.

6. Queen Cells

Queenless hives accept queen cells very well. Just find a dark comb in the middle of the nest and mash down some cells with your fingers. Carefully, push the thickened bottom portion of the queen cell into the comb and use the mashed area to give space for the cell to hang downward. The bees will attach the cell to the comb and the queen should hatch out and be accepted. Handle queen cells very carefully to avoid damaging the queen. She is very sensitive to mistreatment while at certain stages of development. Do not bend the cell at all when attaching it in a perpendicular position. Try to keep the cell warm during transport: 75° to 90°F is best, but



Sealed queen cell

don't let it dry out, either. If the weather is cool (below 60°F), the best place to attach the cell is in the middle of the brood nest near the top of the comb.

Seasonal Management

With the problems that we now face with varroa mites, beekeepers are finding that they need to be a little more flexible on the timing of certain operations, such as medications, queen introductions and the honey harvest. Each spring, there is a swarming season and a nectar flow that will depend on the weather and its influence on flowers. It is good to be aware of the weather and to know what important flowers are blooming. This makes you a better beekeeper, because you will be prepared to help your bees at the right time, and it keeps you in touch with nature. Some suggestions for a seasonal management schedule are given below (dates are typical for the Midwestern region, but your schedule will have to adapt to the local weather).

December to February

Downtime. Work on equipment and read beekeeping magazines and books.

An apiary in late winter

February

This is usually a time when you can check your bees, if the temperature is above 40°F and there is no wind. Check your hives briefly. If a hive is dead, it can be marked as such or stored. The comb should be protected from wax moths by putting moth crystals on it or storing it in a cold place once the temperature is above 60°F. If there is any brood, immediately close the hive to keep from chilling the brood. Brief inspections of brood can be done on days that are above 50°F with no wind, or above 55°F with light wind. This could be a time to reduce your varroa mite levels, but this is usually done after the honey harvest. If there is no sealed brood, all of the mites will be exposed to the miticide because they will not be able to hide beneath the cell cappings. The need for mite control will depend on mite populations, but one treatment per year is usually required as soon as honey is removed. If you are using mite treatments that rely on evaporation of something (like thymol), these must be done when it is warm enough. Read the directions for the particular product you are using to determine if the weather is warm enough.

Hives should be inspected for food stores about the time that they are beginning to rear brood (usually January or February, weather permitting, or this may be put off until March). If colonies did not have adequate stores going into

winter, they may be starving in February even without brood rearing. Colonies can be fed in cold weather by putting granulated sugar (white) on the inner cover. Another efficient feeding method for the winter is to make a cake of hard candy following the recipe below. These are also called "candy boards."

Winter Bee Candy
15 pounds granulated sugar
3 pounds clear high-fructose corn syrup
4 cups water
1/3 tablespoon of cream of tartar

Mix the ingredients and heat it to 242°F (use a candy thermometer to determine the temperature). Pour the heated mixture into molds to make flat cakes that will fit on top of an inner cover. Place the hardened cakes over the inner cover (keeping the opening free for the bees to feed). Some people use special boards that take the place of the inner cover.

Late February or early March is usually the best time to put on pollen substitute in the Midwest, if supplemental feeding is planned to stimulate earlier egg laying by the queen. Pollen feeding should be done about six weeks before reliable sources of nectar can be obtained from early flowers (like maple trees and dandelions). Pollen substitute can be purchased from a bee supply company. Unless you buy prepared patties, you will need to mix it according to the directions. Some people trap bee pollen and store it in their freezers to add to their pollen substitute and make it tastier for the bees. **Hint:** Make pollen substitute the day before you intend to use it to make sure it doesn't get too hard or soft when it sets up. If it gets hard or dry, the bees won't eat it. If you put the pollen substitute between wax paper, it will not leave a mess on the frames and will be easier to apply.


Pollen patties can provide much-needed protein.

March

Often the bees get their first fresh pollen in March from the maple trees and willows. Make sure that hives have adequate food. More colonies starve to death in March than in any other month because as bees begin rearing brood, they eat up honey and pollen at an alarming rate. A convenient way to feed bees is with a division board feeder. This feeder takes the place of a frame inside the hive so bees can have easy access to the syrup. Give them equal volumes of sugar and water in the spring. Combine very weak colonies with stronger ones.

Equalize colonies somewhat by stealing a frame of brood from each of the strongest hives and giving them to the weakest hives. Colonies that need honey can be given a frame from the stronger hives, or fed syrup.

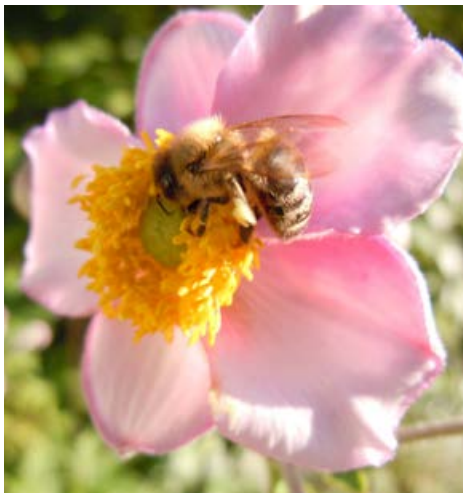
Some beekeepers do a preventive treatment for American foulbrood disease at this time. This is no longer recommended unless your colonies have had this problem in the recent past or show foulbrood symptoms. There have also been occasional problems with European foulbrood, and both types of disease usually can be cleared up with the following treatment: Mix one 6.4 oz. pack of terramycin with 2.5 lbs. of powdered sugar. This should be fed to the bees in three doses, five days apart. Each feeding should consist of about 3 tablespoons of sugar/terramycin mix sprinkled on top of frames at the edge of the hive.


Treating a hive with antibiotics in powdered sugar

Overuse of antibiotics may select for antibiotic-resistant foulbrood, and there have been reports of terramycin-resistant American foulbrood already. If you inspect your hives regularly, you will see when a foulbrood problem occurs and can cure it before it gets out of control. If you only see a few cells showing the problem, inspect again to see if it clears up. Often poor weather can result in poor brood or chilled brood that may look like disease, but later the problem resolves itself. If you do have combs with a lot of foulbrood, they should be burned or put in a well-sealed garbage bag and thrown away to prevent spread of the disease.

April

Continue to make sure there is adequate food if the weather is cold or rainy. A strong colony that is occupying two boxes should have at least three full frames of honey. However, if the weather is good and the honey isn't available, the bees should be able to forage on dandelions and spring flowers and get by. Feeding in bad weather will stimulate more rapid brood rearing, and may be necessary to prevent starvation in some cases.


Pollen forager on an anemone

Begin swarm control in April. Split the strong colonies, if you have the extra equipment to start new colonies (perhaps using equipment from winter losses). Another practice some beekeepers use is to reverse the brood boxes to stimulate the cluster to move up and expand the brood nest. The brood nest is usually at the top of the hive at the end of winter. Placing this box on the bottom board and putting the nearly empty

bottom box above it may reduce crowding of the brood nest and may prevent swarming. You can also put a super with empty combs underneath the brood nest. This provides room for returning foragers to stay and helps reduce crowding of the brood nest if it extends to the bottom. You may want to use a queen excluder to keep the brood out of that box.

If the swarming instinct is not curtailed, only the most tedious methods can prevent swarming. For a hobby beekeeper with a few colonies, these methods are feasible (but not always successful). Once the bees start constructing swarm cells at the bottoms of the frames, go through the colony every 7 to 10 days and cut all the cells. But **BE CAREFUL!** Before you cut cells, make sure that you see eggs in the colony. The queen may have stopped laying eggs and be about to swarm, or she may have already swarmed, and you didn't notice that there are fewer bees. You do not want to make the mistake of cutting all of the cells and leaving your colony hopelessly queenless!


A swarm on a tree

May

Make sure the bees have plenty of room. Give them new brood chambers or supers before they need them to reduce crowding. The extra empty comb will stimulate increased foraging and honey production. Flowers are starting to give nectar — dandelions, autumn olive, Asian honeysuckle, tulip poplar, and others. Sometimes black locust trees produce a short nectar flow at the end of May and basswood trees can produce honey in late May or June.


A full frame of sealed brood!

If you are raising your own queens, May is usually the best time to start because it is swarming season and the bees have the instinct to raise queens. You can also carefully remove swarm cells and add them to queenless hives by hanging them between the frames or attaching them gently to the side of a brood frame, hanging down in their natural orientation. This time of year there should be plenty of drones for the queens to mate with when they are ready.

June

This is the month the honey flow really starts. The clovers are producing nectar and should be in full gear by the end of the month or early in July. Make sure all the supers are on. If you raised your own queens in May, you could introduce them to small nuc hives and let them mate in late May or June.


Sweetclover in June

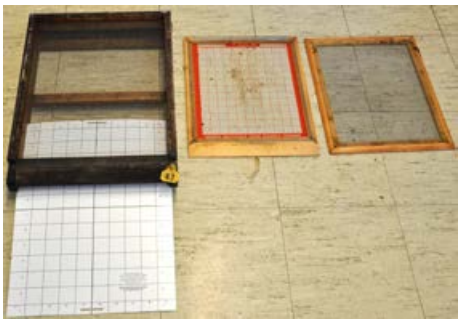
July

If you are raising queens, you could remove the queens from some of your hives as you have time toward the end of

the nectar flow. Replace the queens that show poor brood patterns or are not laying enough eggs, or queens from colonies that show signs of disease. The honey flow from clover usually stops about the end of July or beginning half of August in the Midwest. Finding queens in big colonies is difficult. It is best to keep marked queens! The day after the old queen is removed, fuse the nuc with the large queenless colony to introduce the new mated queen, or introduce her with some other method, such as a candy cage.

August

Often, the real honey flow is done by the end of the first week of August. It is important to get the honey off as early as possible and to treat for varroa mites. This is perhaps the most critical thing to help your bees survive the winter.



Two kinds of holders for sticky boards to check mites

You should monitor your hive for varroa mite populations with sticky boards or some other method so that you will have a good idea of whether you need to treat them and which hives need to be treated. The sticky boards can be purchased or made by cutting 3/8-inch doorstop wood strips and constructing a rectangle to which you staple screen that the bees cannot get through. Put contact paper on the back and spray it with vegetable oil before sliding it in the colony entrance. Count the number of mites that fall in a 24-hour period, or put it in for several days and divide by the number of days.

You can also check for mites on adult bees with the powdered sugar shake method. The sugar shake is done by putting half a cup of bees (about 400 bees) in a quart jar with a screened lid. Put several tablespoons of powdered sugar on them, let them set for two minutes, then shake the mites onto a white sheet and count them. For detailed instructions, see www.ent.uga.edu/bees/disorders/documents/VarroaMites_155.pdf (PDF document, 263 KB).

Choose the method that is convenient for you. As soon as the supers are off, hives that have high mite levels should be treated. There are a number of products available. Apivar strips contain amitraz, which is a good miticide. If you want to avoid pesticides, you can use a "softer" chemical such as thymol (synthetic oil of thyme) that is available in several products. Always follow the manufacturer's label instructions for all products. R ead more about this in *Parasitic Mites of Honey Bees* (extension.entm.purdue.edu; search by publication title. PDF: 1.4 MB). Controlling the mites now will insure that healthy bees are raised during September

Bees robbing from supers after honey extraction

and October. They will be your "winter bees." They will need to live all winter long and still be able to forage and feed the brood in the spring. Normally, the nurse bees feeding brood are young bees, so the old winter bees have to be healthy and rejuvenate their brood food glands in the spring. Brood food glands are the glands in the heads of nurse bees that make royal jelly to feed larvae. In contrast, working bees in the summer only live about six weeks or less.

Once the honey supers have been harvested, the honey needs to be extracted and bottled. The wet supers can be returned to the hives (after the mite treatments are completed) to let the bees clean them up. Sometimes beekeepers just set the supers out in a shady place and let the bees rob them out. Some people store their supers wet, which is OK, but they will smell a little sour from fermentation and may have a little mold, which is also OK. The bees will clean them up in the spring. Stored comb will require paradichlorobenzene (PDB) moth crystals when the weather is warm (above 60°F). It is important that you reduce the entrances of any weak colonies that may get robbed out by stronger colonies when the nectar flow stops in August. When you work your bees, do not leave honey exposed too long or your bees will get used to robbing from each other.


It is important to have stores of bee bread when winter comes.

September to November

Hopefully in late August and early September the bees found lots of nectar in goldenrod and aster flowers and are storing pollen for the winter. The small, white asters are often important for the fall flow in the upper Midwest, but the fall flow is not dependable. Weak colonies should be combined with stronger ones before the winter. Colonies that are merged should be reduced to two or three deep boxes. You could use three boxes for very strong ones that you will split next year. Extra boxes and comb should be stored in an unheated building with covers on the top and bottom. When storing equipment in hot weather, note that wax moths can destroy the comb in two weeks. If it is going to be warm, you should keep several tablespoons of paradichlorobenzene (PBD) moth crystals on them. (Be careful not to use naphthalene crystals.) Stack the boxes and put crystals on newspaper on tops of frames for every four to six boxes. Either nail wooden entrance reducers in place leaving the smallest opening (3/8-inch high), or staple 3/8-inch hardware cloth all across the entrance. The 1/2-inch hardware cloth also works and is easier to find, but some mice are small enough to get through it.

If your colonies do not have at least six deep frames of honey for the winter, it is best to feed them 2:1 syrup (twice as much granulated sugar as water, by volume). You can dissolve it in hot water. Fumidil-B powder can be added to help control for Nosema disease (dysentery), but this is costly and the benefit may not be worth the expense. It is only necessary to feed your bees in the early spring or late fall, or when you are trying to get them to draw comb on foundation. Often in the Midwest, the bees make enough fall honey for themselves, and we do not have to feed them. Put mouse guards on your hives. This is most easily done by stapling 1/2-inch hardware cloth over the entrance or just bending it lengthwise and shoving it in the entrance. Remove this in the spring so the workers can more easily take out the dead bees.

Woodland asters

Colony Troubleshooting

Your primary concerns should be the presence and well-being of the queen and the levels of varroa mites. It often is unnecessary to find the queen. If you do not see her, look for eggs by letting sunlight shine into the bottom of the cells. If eggs are present, there was a queen at least three days ago, because it takes three days for an egg to hatch. Also, look for queen cells. Swarm cells are queen cells made in preparation for swarming in the spring and are usually toward the bottom of the comb. Emergency and supercedure queen cells are usually found toward the middle of the comb. When a queen is failing and they are making a supercedure queen cell, sometimes it is best to let the bees replace her. However, this may cause a break in brood rearing of 2 to 3 weeks.

Bee bread and nectar

Common problems and recommendations are given below.

1. Problem: I can't find any eggs or brood!

Possible Causes and Solutions:

a. The queen has quit brood rearing because of the season (winter time or about to swarm) — no action needed.

b. No queen — buy and introduce a new queen ASAP.

Optional test: Add a frame of eggs and young larvae from another hive. Check for the start of queen cells on third day. This indicates they were probably queenless and will now raise a new queen.

c. New queen present but is not yet laying (you may find some sealed brood left from the last queen) — be patient. Queens normally begin laying eggs roughly two weeks after emerging from the cell.

d. Extended shortage of pollen.

2. Problem: There are eggs present, but no other brood.

Possible Cause: Brood rearing has just resumed after being halted. Perhaps they raised a new queen that just mated.

Solution: This is good! No action needed.

3. Problem: I see wet-looking pollen.

Possible Cause: When pollen is not needed immediately, bees put nectar and honey on it. This is "bee bread" and is normal. Yeasts in the bee bread make processed food for the bees.

Solution: No action needed.

4. Problem: There are clean, shiny-looking cells in the middle of brood nest.

Possible Cause: The workers have prepared the cells for egg laying. They should look clean and shiny on the bottom.

Solution: No action needed unless there is no queen!

5. Problem: I see eggs, but more than one egg per cell.

Possible Causes and Solutions:

a. The queen is freshly mated, or not mated — be patient. She will soon learn to put only one egg per cell. However, you should check again in 5–10 days, and replace the queen if this is still happening.

b. Probably the colony has been queenless for two weeks or more and you have a laying worker colony. Some of the workers ovaries have developed and they are laying drone eggs — do not introduce a new queen to this colony. Laying workers usually kill queens that are introduced because the laying workers produce some queen substance as if the colony had a real queen. Usually the laying worker colony is a weak one and can be combined with another colony without too much danger to the queen. Use one of the following methods in this case:

- The easiest and probably best remedy is to merge the colony with another colony. Use the newspaper technique and place the laying worker colony above the one it is to be merged with.
- Try to introduce a queen. Take the hive 20 feet away from its stand and shake all the bees off the frames and out of the box onto the ground. The theory is that the laying workers usually do not find their way back to the hive, or the disruption helps them accept a queen. Set up the hive in its original position. Introduce a queen under a push-in cage that is pushed into dark comb that contains some open honey, and possibly a little capped brood. Be careful to push the cage well into dark comb. Plastic push-in cages seem to work better because bees are less likely to chew around them. Release the queen in three

days if the workers are not biting the cage. (They cling to the cage with their mandibles when biting it and are not easily brushed aside.)

6. Problem: The brood is scattered in an uneven pattern.

Possible Causes and Solutions:

a. Queen is running out of sperm — if this is the cause, requeening is advisable. If nothing is done, the bees will raise a new queen and the current queen will be superceded by her daughter.

b. Something is killing the brood. Cold nights in the spring can kill some brood. Rarely, pesticides and poisons may cause the brood to have an uneven pattern. Or, the problem could be mites or disease.

- Check for possible sources of pesticides or other poisons, if you have not had cold nights recently.
- Check for disease symptoms of foulbrood, chalkbrood, and parasitic mite syndrome.

Clue: Is one colony showing the symptoms or are several? If one, situation (a) is more likely. If several, (b) is more likely.

7. Problem: I found the queen, but I also see a new queen cell that has a neat, round opening at the bottom.

Possible Cause: A virgin queen has recently emerged from this cell.

Solution: If the old queen is present and doing well, and you want to keep her, you should try to find the virgin queen and kill her. Otherwise, the virgin will probably kill the old queen and there will be a break in brood rearing. Another possibility is that the old queen is not performing well. You should evaluate the brood to make sure she is still laying lots of eggs and filling frames with brood. If the brood is spotty, it may be best to let the new queen take over. Queens usually take less than two weeks to mate and begin laying eggs, so you need to be patient.

8. Problem: I opened my hive and suddenly found virgin queens emerging from several cells!

Possible Cause: Your colony was preparing to swarm. When bees are going to swarm and they have multiple queen cells, the worker bees prevent the queens from emerging too soon by sitting on the cells and thumping them. Sometimes the queens are not completely inhibited and begin to chew their

way out, but the workers re-seal the opening before the queen can emerge.

Solution: It is too late to prevent the bees from swarming, if they haven't done so already. If you want queens to requeen other hives, this is a good opportunity. You can capture some of these queens and put them in cages with attendant bees. Add some bee candy (made of powdered sugar and honey or white corn syrup) or give them a drop of honey and put them right into new queenless hives (wait 24 hours after dequeening). Remember to give them a very small droplet of water twice a day if you are keeping them in cages for a while. You can keep them in the cage with candy for about a week. These queens can also be mated in small nucs and kept for colonies that need new queens later.

Short Guide to Using Honey Bees in Pollination

General Considerations

Why use honey bees?

Many crops are dependent on pollination by bees for adequate fruit set. North America has over 3,000 species of wild bees. Some of these species are much more efficient than honey bees on a per-bee basis for pollinating specific plants. But, almost all of the wild bees are solitary. A single female makes a nest, forages, and cares for the brood, so solitary bees do not have colonies. Honey bees are social — they have a colony containing one queen that lays all the eggs, and tens of thousands of worker bees to do the foraging. Furthermore, many wild bees only visit specific kinds of plants or are only active for part of the season. The three primary pollinator bees and their benefits are given below.

- The *orchard mason bee* is useful because it is active during the spring and is an efficient pollinator of apples. Mason bees can be encouraged to nest in plastic straws or holes drilled in wood. Their progeny will return to the same orchard each year.

- *Bumble bees* are important because they are large, active foragers and are also social, living in small colonies that are active throughout the season.

- *Honey bee* colonies also are active throughout the growing season. Worker honey bees will visit any flowers that provide good amounts of nectar or pollen, the two resources bees need for energy and protein. The main

advantage of using honey bees is that you can manage colonies with tens of thousands of bees to serve as mobile pollination units.

What is a good pollinating hive?
A hive that was just started from shaking a package of bees onto a foundation is not a good pollination unit, because the population is low and will continue to decline for at least a month while the bees draw comb for the queen to lay eggs in and the first new workers hatch out. A good pollination unit is a strong hive (meaning it contains lots of bees). A strong hive will have many bees coming and going from the entrance on a warm day. If you take the lid off, there should be bees filling at least one or two large brood chambers, with a carpet of bees covering the tops of the frames. A good pollinating unit will have at least one deep brood chamber full of bees, brood, and eggs (indicating that they have a queen).


Hives waiting to go into almond orchards in California—This is the biggest managed pollination event on the planet.

When do you move your hives?
Bee hives are usually moved after sunset to avoid losing foraging bees. Beekeepers that move only a few hives usually just screen off the entrances and load the hives individually on a truck. Straps can be used to make sure boxes do not come apart if the hive is knocked over. Beekeepers with larger operations often move hives on pallets with four hives per pallet. The grower should expect the hives to come at night and should jointly decide with the beekeeper where the hives will be placed — in the orchard or the edges of the field.

How do you time the move?
The importance of timing depends on what flowers are competing for the attention of the bees. One thing to consider is the attractiveness of your crop as a nectar source. Bees are very good at locating the sweetest nectar in the area. Often this comes from weeds in the surrounding fields. Bees like to forage within 300 feet of the hive, but will travel two miles or more for a good nectar source. Ideally, it is best to have the bees moved into the crop just as flowering has started in earnest, so that the bees do not get used to foraging on the nearby weeds. If they are moved in too soon, there may not be enough of the crop blooming to effectively compete with the weeds.

Consider drawing up a pollination contract.
When contracting for pollination, it is important that the beekeeper and grower discuss details, including all of the following:

- **Pesticides.** Which pesticides will be used, if any, while the bees are present? Bees are extremely sensitive to sprays on flowers. It is possible for a beekeeper to lose all 300 of their colonies in one week to pesticide-poisoning during pollination. The beekeeper and grower should know which pesticides are most toxic to bees.

- **Access.** The beekeeper should have access to the colonies at all times to inspect them and make sure they still have queens and are healthy.

- **Contract.** All of these points should be decided ahead of time. It is best to sign a formal contract with the beekeeper and owner of the crop to be pollinated. This protects both the grower and the beekeeper.

How many hives are needed?
The number of hives needed depends on the crop. Crops with more than one seed per fruit benefit from multiple bee visits to the flowers to get large fruit. Examples of such crops are apples, cucumbers, melons, and blueberries. Blueberries need perhaps the most hives per unit of area, because they are not that attractive to the bees. Examples of some estimates of the optimal number of hives per acre are given in Table 1.

Crop	Hives per acre
Apples	1.2
Blueberries	4.0
Cantaloupe	2.4
Cucumber	2.1
Squash	1.0

Table 1. Number of hives needed for different crops.

Pesticides and Bees

Pesticide Toxicity

The acutely toxic effects of pesticides to bees are measured by experiments in which the test compound is administered to bees as a contact pesticide in a controlled way. Table 2 indicates how pesticides are rated based on their LD50s, or the lethal dose needed to kill 50 percent of the test bees (concentration in microgram/bee, or µg/bee).

LD50s (µg/bee)	Toxicity
less than 100	virtually non–toxic
11-100	slightly toxic
2.0–10.99	moderately toxic
greater than 2.0	highly toxic

Table 2. Classification of toxicity based on LD50s (µg/bee)

Residue Exposure

Some pesticides are very toxic to bees but can still be applied to the blossoms in the evening, because they rapidly decay to less toxic compounds. The residual activity of pesticides is often expressed as an RT25 value. The RT, or residual time, is the time that needs to pass for the pesticide to degrade enough that bee mortality is reduced to 25 percent of the initial mortality of the freshly applied product. This test is done by spraying the pesticide on alfalfa leaves and keeping the leaves in a cage with bees at 75°F. But cooler temperatures can dramatically increase the time needed for residues to become nontoxic to bees. Be especially careful when the weather is cool. More information can be obtained from reading *Protecting Honey Bees from Pesticides* (extension.entm.purdue.edu; search by publication title. PDF: 704 KB).

Keeping Records

The following worksheets (pages 29–33) are provided to help you keep records of your beekeeping expenses and colonies. Keeping records is important so that you know how you are doing and how much you are spending. You can use the tables provided or make your own. Using Microsoft Excel® on a computer makes it easy to sum your costs.

Inventory of Beekeeping Equipment

Date Obtained	Item	Number	Cost
		Total:	

Receipts

Date	Item	Value — Used at Home	Value — Sold
		Total:	

Financial Summary

Assets:

Total value of bees, equipment, etc., on hand January 1.	
Total value of supplies, equipment, etc., purchased during year.	
Miscellaneous expenses during the year. Explain:	
Total:	

Inventory:

Total value of bees, equipment, etc., on hand December 31.	
Total value of bee products available for sale December 31.	
Total:	

Total pounds of honey produced:

extracted (_____pound) + chunk (_____pounds) + comb (_____pounds)

= _____ pounds

Value of bee products sold: _____

Yearly Profit (or Loss) =

Assets — Inventory + Value of bee products sold.

_____ – _____+ _____ = _____

Yearly Profit/Loss: _____

Work Record

Record all time spent working on your beekeeping project.

Date	Location	Kind of Work	Time Spent
		Total:	

Apiary Record

(Maintain a record book for your hives with a chart for each individual colony.)

Colony No.								
Date	Queen	Brood Amount	Amount Pollen	Amount Honey	Bee Population	Honey Removed	Equip-ment	Notes

Colony No.								
Date	Queen	Brood Amount	Amount Pollen	Amount Honey	Bee Population	Honey Removed	Equip-ment	Notes

Colony No.								
Date	Queen	Brood Amount	Amount Pollen	Amount Honey	Bee Population	Honey Removed	Equip-ment	Notes

The Scientific Method

Scientific Method – an organized way to address a problem you are having with your bees.

1. Stating the problem

Think about what you want to learn.

2. Forming the hypothesis

After you choose a problem to study, describe what you think is happening.

3. Observing and experimenting

Observe or set up an experiment to test your hypothesis. Tally your data. You can make your own charts by hand or on the computer.

4. Interpreting data

Once you have collected your data, you need to understand what it tells you. The data can be interpreted by comparing numbers visually or in graphic form.

5. Drawing conclusions

Consider how your observations and/or experiments affect your hypothesis. Is the hypothesis supported or rejected by your observations and experiments? How do the results give you ideas for future studies and a new hypothesis? Should you run your experiment again? Should you change one of your variables?

Worksheet components:

1. State the problem.
2. Write a hypothesis.
3. Observe and experiment (create a data sheet).
4. Tally, study, and interpret your data.
5. Draw conclusions.
    a. Was your hypothesis supported, or not?
    (*Circle one*) Yes No
    b. What else did you learn?

Demonstrations and Talks

Any one of the suggested projects could be an excellent topic for a demonstration or discussion at your school, county, or state fair. You might also be able to find other clubs and groups that would be interested in such a presentation. Talks are generally more interesting if you do an interactive demonstration. General guidelines and a checklist for an interactive demonstration are given in this manual.

Interactive Demonstration Guidelines

An interactive demonstration is one of a number of verbal communication events that 4-H members can present at the Indiana State Fair and in many counties. It is a fun way to share what you have learned in your 4-H project with the public. It's a kind of "show and tell" but with more action. An interactive demonstration is not a speech, where the audience sits and listens to a prepared talk. It is an opportunity to get your audience involved in learning about your 4-H project work. Youth of any age may participate. See the Indiana 4-H Project website (www.four-h.purdue.edu/projects; click on Verbal Communication Events and Activities) for more information about interactive demonstrations and other options for youth in grades 6–12.

Interactive demonstrations can be given anywhere there are a lot of people, such as a county or state fair, shopping mall, street fair, or other 4-H event. Your job as a demonstrator is to interest the audience in your topic so that they stop and learn something new or try their hand at what you are doing.

How do I choose a topic for my interactive demonstration?

An interactive demonstration can be done on almost any subject. The topic should be something that you enjoy and are knowledgeable about. Consider the following questions when choosing a topic.

- Can you complete the demonstration in 3 to 5 minutes?
- Can it easily be repeated over and over again to fill the assigned time?
- Is your interactive demonstration showing something that would interest the general public?

- Is there a good way to involve your audience in your activity (hands-on or answering questions)?
- Can the supplies for the "hands-on" section be used over and over again, or will they need to be replaced? (If the materials must be replaced, it will cost more to do the demonstration.)

How can I get the audience involved?

The first thing you need to do is be enthusiastic and attract people's attention as they walk by your table. You might have a colorful tablecloth or poster to spark their interest. You might ask them a question, like: "Would you like to play this game?" or "Have you ever made pretzels? Would you like to try?" The best way to attract their attention is to have people around your table doing something. People love to do hands-on activities, so once you get a few people at your table, they will attract others.

Involve your audience by having them:

- Do what you are doing
- Do a "hands-on" section
- Judge the quality of various items
- Play a game
- Answer questions

Remember, the key to a good interactive demonstration is getting your audience involved.

Interactive Demonstration Checklist

Topic	Yes	No
Was the topic interesting to the general public, causing them to stop, watch, or participate?		
Did the topic stimulate questions from the audience?		
Was the topic of suitable length?		
Did the topic include something "hands-on" for the audience to do?		
Organizing the Content	**Yes**	**No**
Was the topic organized into short "show-and-tell" segments that were done repeatedly?		
Were segments presented in logical order?		
Were segments explained so that the audience understood "why?"		
Was it evident that the 4-H member was knowledgeable about the subject and could answer questions?		
Did visuals, pictures, posters, or actual objects clarify the important ideas?		
Presenting the Demonstration	**Yes**	**No**
Did the 4-H member seem enthusiastic?		
Did the 4-H member encourage the audience to become involved in the demonstration?		
Did the 4-H member speak directly to the audience?		
Did the 4-H member show evidence of practice and experience?		
Did the 4-H member show that she/he enjoys talking to the audience?		
Did the 4-H member show enthusiasm, friendliness, and a businesslike manner?		
Did the 4-H member tell about what they learned through this 4-H project?		
Comments:		

Exhibits

You should get information about the 4-H Beekeeping exhibit from your county Extension educator. Indiana State Fair guidelines are available at the Indiana 4-H website (www.four-h.purdue.edu/projects).

The displays that you could design are as numerous and varied as the many types of projects you have to choose from.

If you exhibit honey, judges will evaluate its color, body, flavor, uniformity of weight and appearance, clarity, moisture content, crystals, and freedom from contamination. Judges will also evaluate the neatness of the container.

Project Suggestions

- Hive increases
- Uniting hives
- Fall and spring management
- Dividing hives and introducing a queen to a hive
- Dividing colonies for increase
- Queen production
- Queen rearing
- Double queen method
- Two-queen system of honey production
- Hive swarms
- Summer management
- The bee language
- Bee hunting
- Construction of an observation hive
- Research on honey bees and pesticides
- Home-built beekeeping equipment
- Protecting honey bees from pesticides
- Bee behavior
- Section comb honey production
- Selective honey gathering
- U.S. standards for grading honey
- Collecting pollen for supplemental feeding
- The value of the honey bee as a crop pollinator
- Use of honey bees for crop pollination
- Construction of a simplified pollen trap for use on colonies of honey bees
- Processing and uses of beeswax
- Pollination of agricultural crops
- The history of hive bodies
- Designing and building a hive stand

Resources

Recommended Magazines

American Bee Journal, http://www.dadant.com/journal/

Bee Culture, http://www.beeculture.com/

Recommended Books

Honey Bee Biology and Beekeeping, by Dewey M. Caron and Laurence J. Connor. Wicwas Press. Cheshire, Connecticut. 2013. ISBN 9781878075291.

The Hive and the Honey Bee. Dadant and Sons Publisher. 1992. ISBN: 0-915698-09-9

Purdue Beehive Website

There are many beekeeping resources listed at the Purdue University Beehive site: http://extension.entm.purdue.edu/beehive/

Indiana Department of Natural Resources (IDNR) — http://www.in.gov/dnr/entomolo/2893.htm

The state apiary inspector is employed by the Indiana Department of Natural Resources, Division of Entomology and Plant Pathology, and is located in Indianapolis. This site has general information about honey bees as well as regulations and applications for moving bees into Indiana from out of state.

Driftwatch Website (https://driftwatch.org/)

This website allows you to easily map out where your bee hives are so the pesticide applicators that use the site can try to avoid pesticide drift that could kill your bees.

Suggested Reading

Brother Adam, 1983. *In Search of the Best Strains of Bees*, Dadant and Sons, Hamilton, IL.

Furgala, B., M. Spivak, and G. S Reuter, 2000. *Beekeeping in Northern Climates*, University of Minnesota, St. Paul, MN.

von Frisch, K., 1967. *The Dance Language and Orientation of Bees*, Harvard University Press, Cambridge, MA.

Gould, J. L., and C. R. Gould, 1988. *The Honey Bee*, Scientific American Library, W. H. Freeman & Co. New York.

Graham, J. M. (ed.), 1992. *The Hive and the Honey Bee*, Dadant and Sons, Hamilton, IL.

Laidlaw, H., and R. E. Page, 1999. *Bee Genetics and Breeding*, University of California Press, Davis, CA.

Spivak, M., and G. S. Reuter, 1997. *Successful Queen Rearing*, University of Minnesota, St. Paul, MN.

Wilson, E. O., 1971. *The Insect Societies*, Harvard University Press, Cambridge, MA.

Glossary

Afterswarms – Swarms that leave a colony with a virgin queen after a swarm of the same season has already left the hive.

American foulbrood – An extremely contagious disease of bees that affects them in the larval (worm) stage of development caused by the bacteria *Bacillus larvae*.

Apiary – A collection of colonies of honey bees; also, the yard or place where bees are kept.

Apiculture – Beekeeping.

Bee escape – A device to remove bees from supers or buildings; constructed to allow bees to pass through in one direction but to prevent their return.

Beehive – A box or other structure for housing a colony of honey bees.

Bee space – An open space (1/4 to 3/8 inch) that permits free passage of a bee but too small to encourage comb building.

Beeswax – The wax secreted by honey bees from eight glands within the underside of the abdomen and used in building their combs.

Bee veil – A wire screen or cloth enclosure worn over the head and neck for protection from bee stings.

Bottom board – The floor of a beehive.

Brace comb – Small pieces of comb built between combs and the hive.

Brood – Young developing bees found in their cells in the egg, larval, and pupal stages of development.

Burr comb – Small pieces of wax built upon a comb or upon a wooden part of a hive but not connected to another comb or part.

Castes – The different kinds of adult bees in a colony: workers, drones, and queen.

Cell – A single compartment in a honeycomb in which brood is reared or food is stored.

Chunk honey – A piece or pieces of comb honey packed in a jar with liquid extracted honey.

Clarification – The removal of foreign particles from liquid honey or wax by the straining, filtering, or settling process.

Cluster – The hanging together of a large group of honey bees, one upon another.

Colony – A community of honey bees having a queen, thousands of workers, and (during part of the year) a number of drones.

Cut comb honey – Squares of honey in the sealed comb in which it was produced; cut from a shallow super size frame of sealed honeycomb and then packaged in clear plastic.

Deformed wing virus (DWV) – an extremely common virus often associated with varroa mites that can also transmit the virus. Bees may show no symptoms or may have deformed wings, part of the symptoms of parasitic mite syndrome.

Drifting – The return of field bees to colonies other than their own.

Drone – A male honey bee, arising from unfertilized eggs of queens or workers.

Dysentery – A disease of honey bees causing an accumulation of excess waste products that are released in and near the hive.

European foulbrood – An infectious disease affecting honey bees in the larval (worm) stage of development; caused by the bacteria *Streptococcus pluton*.

Extracted honey – Liquid honey.

Extractor – A machine using centrifugal force for removing honey from the comb without destroying the combs.

Field bees – Worker bees, usually at least 16 days old, that leave the hive to collect nectar, pollen, water, and propolis.

Foundation – Used to form base on which bees can construct complete comb, made of either wax or plastic and imprinted with hexagons.

Frame – Four strips of wood joined at the end to form a rectangular device for holding honeycomb.

Granulated honey – Honey that has crystallized, changing from a liquid to a solid.

Hive – Worker bees available for purchase. As a verb, to put a swarm in a hive.

Hive body – A single wooden rim or shell that holds a set of frames. When used for the brood nest, it is called a brood chamber. When used above the brood nest for honey storage, it is called a super.

Hive cover – The roof or lid of a hive. Usually these are "telescoping covers," meaning they have an overhang around the edges.

Hive tool – A metal tool with a scraping surface at one end and a blade at the other; used to open hives, pry frames apart, clean hives, etc.

Honeycomb – The mass of six-sided cells of wax built by honey bees in which they rear their young and store their food.

Honey flow – A time when nectar is plentiful and bees produce and store surplus honey.

House bee – A young worker bee, 1 day to 2 weeks old, that works only inside the hive.

Inner cover – A thin wooden board placed just beneath the hive cover for added protection and insulation from the elements.

Job shadowing – Learning from others by following, watching, and studying what they do in their jobs.

Larva – The grublike or wormlike immature form of the honey bee in its second stage of metamorphosis

Metamorphosis – The series of stages through which an insect passes: egg to larva to pupa to adult.

Movable frame – A frame of comb that can be easily removed from the hive. It is constructed to maintain a proper bee space, which prevents the bees from attaching comb or fastening it too securely with propolis.

Nectar – A sweet liquid secreted by plants, usually in their flowers, and converted into honey by bees.

Nosema – An infectious disease of the adult honey bee that infects the mid-gut, or stomach. It is cause by a protozoan parasite. Symptoms of this disease closely resemble those of dysentery.

Observation hive – A hive made mostly of glass or clear plastic to permit observation of the bees at work.

Pesticide – A general name for materials used to kill undesirable insects, plants, rodents, or other pests.

Pollen – Dustlike grains formed in the flowers of plants in which the male elements are produced. Honey bees use pollen as a protein food for their young.

Proboscis – The tongue of a honey bee.

Propolis – A kind of glue or resin collected by the bees for use in closing up cracks, anchoring hive parts, etc. It is also called bee glue.

Pupa – The third stage of a developing bee, during which it is inactive and sealed in its cell. The adult form is recognizable during this stage.

Queen excluder – A device, usually constructed of wood and wire or sheet zinc, having openings large enough for the passage of worker bees but too small for the passage of larger drone and queen bees.

Robber bee – A field bee from one colony that takes, or tries to take, honey from another colony.

Sacbrood – A slightly contagious disease of brood that is caused by sacbrood virus. Often associated with varroa mites.

Sealed brood – Brood, mostly in the pupa stage, that has been capped or sealed in cells by the bees with a somewhat porous capping of wax.

Section comb honey – Honey in the sealed comb that was produced in thin wooden frames called sections.

Smoker – A device that burns slow-burning fuels to generate smoke for the purpose of keeping the bees calm while working in their hive.

Solar wax extractor – A glass-covered box for melting down beeswax by the heat of the sun.

Super – A receptacle in which bees store surplus honey placed "over" (above) the brood chamber. As a verb, to add supers in expectation of a honey flow.

Supersedure – rearing a new queen to replace the mother queen in the same hive.

Swarm – A large group of worker bees, drones, and a queen that leaves the mother colony to establish a new colony.

Tracheal mites – *Acarapis woodi* are microscopic and infest the breathing tubes inside the bees' thorax. Most bees are resistant to this parasite.

Travel stain – The darkened appearance on the surface of comb honey when left in the hive for some time; caused by bees tracking propolis over the surface as they walk over the comb.

Uniting – The combining of two or more colonies to form one large colony.

Varroa mites – *Varroa destructor* is considered the most serious cause of colony winter losses.

Virgin queen – An unmated queen.

Wax moth – A moth whose larvae feed on and destroy honeycomb (also called lesser wax moth).

Dec. 2015

PURDUE UNIVERSITY

PURDUE EXTENSION

4-H-571-W

4-H Beekeeping

Division I

Understanding the Honey Bee

Year in Project: _____

Date Started in Beekeeping I: _____

Name: _____

Club: _____

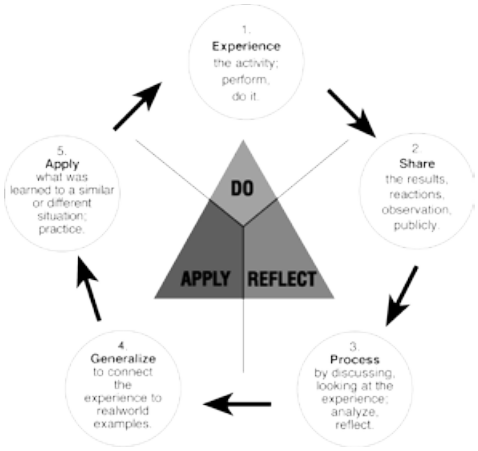
County: _____

4–H Beekeeping, Division I: Understanding the Honey Bee

Note to Parents and Volunteer Leaders:
The 4-H Beekeeping Project helps youth learn about bees and how to be a beekeeper. Beekeeping offers many hands-on educational experiences, from learning about bees and nectar to learning to raise bees and produce honey.

The 4-H Beekeeping Project is divided into three divisions. *Division I, Understanding the Honey Bee*, covers information on the basic facts of beekeeping: the types of bees, the honey and wax they produce, the plants that attract bees, and the equipment a beekeeper needs. In the first year, youth are not required to have any bees, but prepare to take care of a honey bee colony of their own. In *Division II, Working with Honey Bees*, youth acquire a colony of bees and learn how to care for their beehive throughout the year. This will include basic beekeeping operations that result in the production of extracted, chunk, or cut comb honey. When the youth are experienced and knowledgeable in the basic care of a beehive, they should move on to *Division III, Advanced Beekeeping Methods*. The advanced topics include: increasing the number of your honey bee colonies, increasing honey production, producing special kinds of honey, learning more about the bee societies, and how to manage honey bee diseases and parasites.

The learning experiences have been planned as "experience-centered" activities. Youth are encouraged to take responsibility for their beekeeping projects. They can enhance their learning by consulting resources on the Internet, at school, and at the library, or by talking to someone who raises bees. Youth are encouraged to have an experienced beekeeper as a mentor.



Experiential learning distinguishes 4–H youth development education from many formal educational methods. Activities are designed so youth experience a learning activity, reflect on what they did (explore the meaning of the activity), generalize what they learned (to test comprehension and appreciation of the activity), and then think about how they can apply what they learned to other situations (generalize). You can help guide youth as they explore each activity by discussing each section.

Purpose

Division I Beekeeping is intended to help youth learn:

- about the types of bees, honey, and wax they produce;
- about the plants that attract bees;
- about the equipment that a beekeeper needs;
- how to compile beekeeping records;
- how to present the results of their work to others;
- how to develop inquiring minds—the habit of asking questions and searching for answers.

Purdue University staff who contributed to this publication:

- Natalie Carroll and Greg Hunt.
- Reviewers Tom Turpin and Larry Segerlind

Understanding the Honey Bee

Beginning Beekeeping

A master beekeeper who worked with honey bees for more than 50 years often said, “Every time I look into a beehive, I learn something new about the bees, and I see another reason why I like the bees so much.” This 4-H Beekeeping Project will help you learn about bees and how to be a beekeeper. It will not turn you into a “master” beekeeper, but it will help you get started.

Selecting an Advisor

The only experience most people have had with bees is stepping on one when running barefoot through the grass. You know, of course, that there is much more to bees than stings, or you would not be taking this project. However, the “bee in the grass” experience should have taught you a fact about honey bees: they will sting if they think they are in danger.
Actual experience is the best way to learn about bees. An experienced beekeeper is your best source of information about honey bees. In fact, it is almost impossible to start working with honey bees without the advice of a helpful beekeeper. Plan to watch and study a beekeeper (job shadowing) taking care of his or her hives. The more you see, the more you will understand. Ask questions. Do not be worried if the amount you have to learn seems overwhelming. There is a lot to learn, but you have time to learn it all. Beekeeping can be a lifetime vocation and hobby. You may find it helpful to purchase a journal to keep notes about what you are learning. Then you can refer back to the journal when you are not with the beekeeper and in future years. You can also use your journal to write questions that you think of so you will remember to ask them the next time you are working with the beekeeper. You can help repay the beekeeper for sharing their time and expertise with you by offering your help with the many tasks involved in beekeeping.

If you don’t already know a beekeeper, your county Extension educator may know beekeepers who live in your county or nearby and who are interested in helping you with this project. The Purdue Extension bee specialist and the Indiana beekeeping associations are also interested in helping young people get started in beekeeping. See the Resources section of this manual for contacts.

It is a good idea to learn what you can about bees before you meet your beekeeping advisor. This will help you know what questions to begin asking. You need a basic understanding of bees and their activities so you will know what your advisor is talking about and showing you.

Try to read this manual (*Understanding the Honey Bee*) and complete the questions before you meet with your advisor. The 4-H manuals give you a little information about bees and beekeeping, but you will need other resources to answer the questions in the manuals. Most of the answers to these questions are in the book *The New Starting Right with Bees* (21st Edition). This book is an excellent investment for the beginning beekeeper. You will use it in all divisions of your 4-H Beekeeping Project, and it will be useful as long as you are a beekeeper. (Ordering information for this book is in the References section at the end of this manual.) Find information about beekeeping from beekeeping journals, at your local library, or on the Internet. If you are interested in learning more about beekeeping we recommend that you take a subscription to either the *American Bee Journal* (http://www.dadant.com/journal/ - ***phone***: 217-847-3324) or *Bee Culture (www.beeculture.com)*. Both are excellent journals that will teach you a lot about beekeeping.

Some of the questions in this manual are more difficult than others. You may not be able to answer all of them until you have more experience in beekeeping. Try to answer the questions, then discuss the more difficult ones with your advisor.

History of Beekeeping

The Native Americans who lived in America prior to 1500 had never tasted honey. This was because only people in Europe, Asia, and Africa had honey bees. There were no honey bees in this country until they were brought here by boat in the sixteenth century, about 50 years after Columbus first sighted America.

Throughout history, there has always been a close relationship between honey bees and people. Drawings on rocks found in Spain that date back 9,000 years show women taking honey from wild bee colonies. Early people took honey from hollow trees full of bees that they found in the forests. In the autumn, these early "bee-hunters" would kill or chase the bees away from their log homes so they could take all of the honey. Honey was very important, because at that time people had no other source of concentrated sugar. As humans learned more about bees, they built beehives of clay pots, straw baskets, and wooden boxes. They wanted to find ways of controlling their bees so that the colonies could survive from year to year and still produce enough honey for the needs of the beekeepers.

In the sixteenth century, scientists began studying the habits of honey bees, hoping to find new ways to control them.

However, it was not until 1851 that beekeeping became a modern science. In that year, an American minister, Lorenzo Lorraine Langstroth, discovered the importance of "bee space." Bee space is an open space of about 3/8 inch that the bees leave between their honeycombs so that they have room to move and work. Based on the "bee space" idea, Langstroth built the first modern beehive with frames of combs that could be easily removed from a wooden box. His invention led to many improvements in beekeeping equipment. Today, beekeeping is more successful than it was before Langstroth's movable-frame hive, because the entire hive can be inspected and manipulated.

The Value of Honey Bees

Honey bees are valuable. They contribute to the success of American agriculture and industry. You probably already know one use of honey: as a delicious sweetener on biscuits, bread, and rolls. Honey also has several other uses that make it a very important product of American agriculture. It is a main ingredient used in the baking and candy industries. Athletes may use honey for quick energy. In the medical profession, honey has been used for its antiseptic qualities in burn ointments and in the preparation of medicines. Throughout history, honey has been used in the production of wines. Honey wine—meade—is still a very popular drink in many parts of the world.

Beeswax, another product of the honey bee, also has many important uses. The cosmetic industry uses beeswax in the preparation of products such as cold creams, lotions, rouges, and lipsticks. Beeswax is a basic ingredient in many candles. Manufacturers of pharmaceuticals include beeswax in many preparations of salves and ointments. Dentists use it for impression wax. Foundries need it for molds in precision casting. Beeswax is an ingredient in many types of polishes for floors, furniture, and shoes. Other uses include adhesives, crayons, chewing gum, inks, basketball moldings, ski wax, thread wax, ironing wax, and archer's bow wax.

If there were no honey bees in this country, American farmers could not produce nearly enough of some of your favorite foods, such as apples, peaches, almonds, and watermelons. This is because many plants must be pollinated to produce fruit. Pollen grains must be transferred from the male parts of the flowers to the female parts to make a seed. Honey bees do this by pollinating flowers. In fact, honey bees do 80 percent of all crop pollination.

There are several reasons why honey bees are such excellent pollinators. First, they are very hard workers. An individual bee may visit as many as a thousand flowers in one day. During these flower visits, the large, hairy bodies of the bees easily pick up and hold many tiny pollen grains. Second, bees visit only one type of flower on a particular trip. Third, beehives can be moved easily into areas where flowers need to be pollinated. Because of these special bee qualities, American crop producers rent millions of colonies honey bees each year to pollinate their crops.

Read Chapter I, "Suddenly You're a Beekeeper" in *The New Starting Right with Bees*. Then answer these questions:

What basic steps should you follow to keep an unexpected swarm?

_____

_____

_____

_____

Briefly describe the nine "Directions for Hiving Your Package."

1. _____

_____

2. _____

_____

3. _____

_____

4. _____

_____

5. _____

_____

6. _____

_____

7. _____

_____

8. _____

_____

9. _____

_____

These crops must be pollinated by bees to produce food yields:

Almonds
Apple
Blueberry
Cherry
Cucumber
Peach
Persimmon
Pumpkin
Watermelon
Blackberry
Cantaloupe
Clover
Pear
Plum
Raspberry
Squash

These crops have higher yields if the honeybee visits them:

Eggplant
Lima Bean
Pepper
Strawberry
Grape
Okra
Soybean

Bee Stings

A basic part of beekeeping is understanding and accepting the fact that you are going to be stung from time to time. No matter how good a beekeeper you become, occasionally you will accidentally crush a bee. You may visit the hives when the bees are disturbed by a change in the weather, by hunger, or by something else beyond your control. As a result, you may be stung.

A few people have serious reactions to bee stings. They may have difficulty breathing after being stung or have some other very dangerous reaction. If you are ever with a person who is severely allergic to a sting, take them to a doctor immediately. It is very unusual for a person to have such a bad reaction to stings. For most people, the sting of the bee is a momentary discomfort that says to slow down, be more careful, or in some way, show greater respect for those honey bees. Do not open a hive alone until you know your reactions to bee stings. If you are highly allergic to stings, you should be particularly careful when working with bees and you should go see an allergist before you consider continuing with this project.

The experienced beekeeper knows what to expect when they get stung and what to do to reduce the bad effects of the sting. You don't need to be afraid of the honey bee sting. A sting always hurts. Whether it is a first sting or the thousandth, it will hurt, but not too much. A bee sting is like getting a shot from the doctor; it will hurt for 20 seconds or so, then the pain fades away.

The beekeeper knows that only the worker bee stings. Her stinger is barbed, like a fish hook. When she pushes her stinger into your skin, it catches and pulls out of her body as she flies quickly away, causing her to die soon after. What she leaves in your skin is the barbed stinger attached to a poison sac. Often part of the bee's intestine is still attached to the stinger in your skin.

You can scrape the stinger off the skin using a fingernail or hive tool. Then puff smoke from a smoker or rub dirt on the area of the sting. This covers the smell of the sting so other bees won't be disturbed.

The experienced beekeeper also knows that swelling will probably develop around the spot where the sting was and may last a day or so. Although an ice treatment may reduce the swelling, there is really not much to do for it, except to get stung again! It seems that the more a beekeeper is stung, the less of a swelling reaction will result. So, there is some good in being stung; it will not be so bad when you are stung again.

The Castes of Honey Bees

There are three types (castes) of honey bees in every colony:

- Worker bees
- Drone bees
- A queen bee

These bees each take a different length of time to develop from the egg to the adult stage (see Figure 1).

Figure 1. The castes of bees take different lengths of time to develop from egg to adult.

The drone bee is the largest and the worker bee is the smallest (Figure 2).

Read Chapter IV, "Getting to Know Your Bees," in *The New Starting Right with Bees* to learn about the kinds of honey bees.

Describe the queen and tell how her body shape, wing size, and stinger are important to her work. What do you find most interesting about the queen bee?

_____

_____

_____

It usually takes _____ days to develop a queen from the egg to the adult stage. She will remain a virgin queen for about _____ days. Within _____ or _____ days after mating, the queen begins to lay eggs. Unfertilized eggs become drones. Fertilized eggs become worker bees.

Figure 2. Three kinds of bees in a hive (drone, queen, worker).

Drone Queen Worker

What is a drone and what does it do?

_____

_____

_____

List the duties of the worker bees.

_____

_____

_____

Why do some worker bees live to be six months old, and others die after only six weeks?

_____

_____

_____

What are foragers and what do they do?

_____

_____

_____

How is honey made from nectar? (Explain briefly.)

_____

_____

_____

Races of Honey Bees

Like people, bees from different parts of the world look and act differently. Variations in color, size, and habits are the bees' way of adapting to the climate and geography of an area. Today there are three different races of honey bees commonly found in America. All of them were originally brought here from other countries. These are not "pure" races because they have mingled with each other. There is great variability in bees, but each race has some particular characteristics.

Italian Bees

These bees were imported from Italy. They are the most popular bees in the United States because of their excellent habits. Italian bees are usually gentle and are not inclined to swarm (leave the hive in a group to start a new colony). They maintain a high colony population from early spring until late fall and produce beautiful white wax cappings on their honey. Italian bees are generally yellow in color. They are a little more likely to rob honey from other hives than the two races listed below.

Carniolan Bees

The Carniolan bee is almost black in color. This race of bee originated in Austria, Bulgaria, central Europe, Hungary, Romania, and Yugoslavia.They are the second most popular honey bees in this country. Like the Caucasian bees, the Carniolans are very quiet and gentle. Carniolan bees tend to increase their colony population very rapidly in the spring but the increase in colony size can make them more likely to swarm.

Africanized Honey Bees

An African race of bees was imported into South America in 1956. These bees are highly defensive—or you could call them aggressive! They are much more likely to sting than other bees. Once disturbed, they will chase people and animals that come near their hive. However, they are not likely to sting when they are foraging on flowers away from the hive. Africanized bees are now present in some of the southern United States, but are not well adapted to the cold winters of the Midwest. They have some traits that make them well adapted to the tropics, such as a tendency for the colony to grow very rapidly and to swarm often. It is not known whether Africanized bees will adapt to our climate by mating with our European races of bees. If this happens, they may become less aggressive.

If you have a hive of bees that sting too much, even though you are careful not to be rough with them, it is best to replace the queen. They will slowly become gentler.

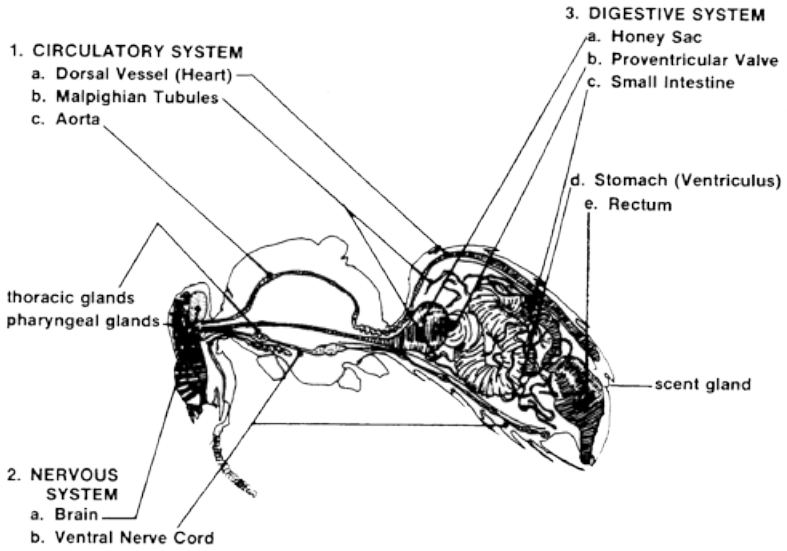
Honey and Honey Plants

People have always valued honey, the primary food of the bees. Men and women use it for many different purposes: as a preventative and cure of disease, as a healthier substitute for sugar, as an ingredient in baking, and as a favorite sweet.

Honey begins as nectar, a sweet liquid secreted in flowers. Nectar is composed almost entirely of sugar and water. It is produced by plants to attract bees. While collecting the nectar, a bee picks up pollen with its body hairs. As the bee visits another flower for more nectar, some of this pollen rubs off. This transfer of pollen causes the fertilization of the second flower, and seeds are produced. Nectar is what the flower pays to the bee for the service of being pollinated.

Nectar usually collects in a tiny pool inside the flower. The amount of nectar the flower produces depends on the type of flower, the weather, the time of day, and the amount of recent rainfall. The visiting bee, a field worker, sucks up as much of this nectar as she can, using her long tongue (proboscis).

The honey bee has two stomachs, a honey stomach and a real stomach. The honey stomach is used only for the temporary storage of honey. It is in front of the real stomach, where the process of digestion takes place (Figure 4). The nectar sucked up by the honey bee's proboscis is held in the bee's honey stomach while she flies back to her hive. At the hive, the field worker transfers the nectar she has collected to three or more "house" bees who suck the nectar from the mouth of the field bee.



Main parts of the digestive, circulatory, and nervous systems of the worker honeybee. [Drawing from The Hive and the Honeybee by permission of Roy A. Grout. (Grout, Roy A., ed. 1975. 5th ed. Dadant and Sons, Hamilton, Illinois)]

The house bee changes the nectar into unripe honey. She does this by moving the nectar about in her mouth and mixing it with chemicals called enzymes. After the mixing process, which takes about 20 minutes, the house bee deposits the unripe honey in a cell for ripening. The new honey ripens through the process of evaporation. Just as water left in a glass will eventually evaporate into the air, extra water will evaporate from unripe honey that is left to sit in the cells. Then ripe honey is all that remains. The time it takes for the evaporation process depends upon factors such as the type of nectar, the air temperature, and the humidity. The bees often fan their wings to speed the evaporation.

The honey is ripe when it is less than one-fifth water. Once the honey is fully ripe, house bees cover it with a thin layer of wax. This protects the honey. The wax covering keeps the honey fresh and safe until it is needed by hungry bees or beekeepers.

Remember that the starting point in the production of honey is in flowers that produce nectar. A beekeeper needs a good knowledge of plants and their flowers. An understanding of honey plants, the plants that produce nectar used by bees to make honey, helps a beekeeper know where to put the hives. The list below shows plants that are important for bees in Indiana. Many of the plants listed do not make much surplus honey because of the duration of the bloom or conditions in a particular year. The best way to determine which plants bees will use to make honey is to watch them. The following list will help you know which flowers to watch.

Honey Plants

The following list (courtesy of Dr. G. Hunt, Purdue University) gives you an idea of the types of flowers that attract bees. The best way to see what your bees like is to watch them!

- **apple blossom (and other fruit trees)**
- **asters (in fall, especially the small, white frostweed aster)**
- **basswood**
- **black locust**
- **blackberry**
- **blue vine or climbing milkweed (mostly in one area of southwestern Indiana)**
- **blueberry (bees are very important for blueberry pollination)**
- **box elder**
- **clover: small white (dutch), yellow sweet, and white sweet (major honey source)**
- **currant and gooseberry**
- **dandelion (important in the spring because it blooms early)**
- **goldenrod (late summer to fall, different kinds)**
- **ground ivy**
- **mint**
- **raspberry**
- **silver maple, red maple (maples mostly important for pollen, not honey)**
- **tulip poplar (tulip tree, the state flower)**

Many exotic plants in people's gardens also attract bees.

Observing the Hive Entrance

The hive entrance of a honey bee colony is very much like the front door of your house. Just as you go through it on your way to and from school, the field bees must exit and enter through the hive entrance on their trips to visit flowers. By watching a hive's entrance, beekeepers can learn a great deal about the levels of activity of their bees. Observing the hive entrance not only tells about the honey plants in bloom that are attracting the field bees, but it also tells about the work going on inside the hive. The more nectar and other supplies the field bees bring in, the busier the house bees will be, storing away and using supplies to build new comb and to care for the young bees.

What is happening at the hive's entrance can also tell beekeepers about the health of their bees. For example:

- If you are too hot in your house, you may sit outside your front door. Bees do the same thing.
- When you are cold, you close the front door. Although the bees cannot close their hive entrance, they will remain inside, away from the entrance, when they are cold.
- When you do not feel well, you stay inside to rest. Sick bees do not leave their hives, either. However, if they are very sick they will crawl out of the hive and die.

Observe the entrance to a hive, watching closely for at least 15 minutes at least once every three weeks. Do this at different times of the day. Sit as close to the entrance as possible so that you have a clear view of the activities taking place. **Do not** sit in front of the entrance! The bees will become confused if they see you in front and won't know where to go. For each observation period, write a report of what you saw. Describe what they were doing there and what, if anything, they were carrying in or out of the hive. Make certain to include the information listed below in your reports:

- the date and time of day of your observation
- the weather conditions while you were watching
- a summary of the activities you observed at the hive entrance
- the types and approximate number of bees you saw

Staple your completed report to the back of this manual.

Fill out the chart below to identify the flowers blooming in your area. Begin your observations early in the spring when flowers start blooming, and continue until late autumn when you can find no more blooming flowers. Remember that you'll find blooms on many trees and vines, as well as the smaller plants you usually call flowers. Bees will fly a mile or two if they do not find what they need near their hive.

Name of Plant	**Description (Type of plant, size of bloom, color of bloom, etc.)**	**Location**	**Blooming Dates (from – to)**	**Bees on Blooms? (If so, describe their activities.)**

Bees get most of the nectar they use from wildflowers, especially clover in Indiana. It is important to know how much wild land is within a mile of your house. Visit these patches and watch for bees.

Beeswax and Honeycomb

The honeycomb is the inner house of honey bees. It is where young bees are raised and where the hive's food is stored. Comb is built out of beeswax, which is produced only by young worker bees. Glands on the undersides of the bodies of these young bees can produce tiny pieces of wax. Worker bees chew these small flakes of wax and work them to form the comb. Generally, the newly constructed comb is beautifully white in color. It may be light yellow when bees are getting nectar from goldenrod or other similar flowers. The comb becomes darker over time, because as each new bee is born, it sheds its skin and this becomes part of the cell. Also, bees collect propolis, which can make the comb darker.

The comb (Figure 5) consists of many small, six-sided tubes (cells) built side by side. The floor of the cells slopes slightly downward to the bottom and is shaped like a three-sided pyramid pointing away from the cell opening. This small slope is necessary so that the substances put into the cell do not slide out of it.

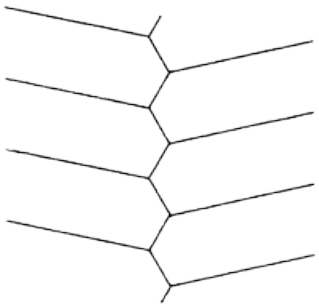
There are three different cell sizes. The large drone bee is hatched from an egg and grows to adulthood in the larger of the two cells (drone cell). The smaller, worker bee grows in the slightly smaller worker cell. Worker cells that are full of eggs, developing larvae, and pupae are usually found in the central part of the comb (brood area). The third cell size is the queen cell.

Bordering the brood area is a narrow strip of worker cells where pollen is stored. Pollen is an important food for the larva growing in the brood area cells, because it is the source of the bees' protein and because it is rich in fat. The field bees collect pollen in the form of tiny pellets from flowers and carry it back to the hive by putting it in small, basketlike pouches on their back legs. This pollen varies in color, depending on the type of flower from which it came.

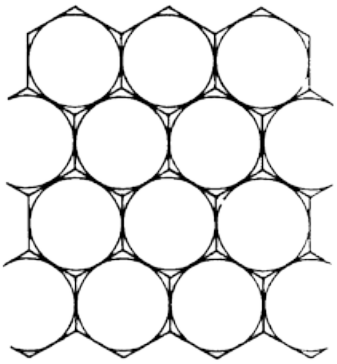
A cell is never completely filled with pollen (Figure 6). Bees generally pack the pollen in a cell until it is about 3/4 full. Sometimes they add a little honey to the pollen to preserve it. This makes the pollen look wet. This storage method maintains the freshness of the pollen for a long time. The outer edges of comb beyond the narrow pollen storage area are used for ripening and storing honey.

Between each comb, the bees leave a space about 3/8-inch wide. If the space between combs is much wider or narrower, the bees will close it up with wax and bee glue.

Figure 5.



Slope of cells from front to middle of comb.



The economy of the hexagonal shape for making honeycomb cells.

It was the discovery of this important space, the bee space, by Langstroth that led to the development of the modern beehive. In the modern beehive, all the frames of comb are specially built so that they are surrounded on all sides by bee space. Because of this, the bees do not clog up the area between the frames of comb. Then the frames can be taken out and put back into the hive easily.

Besides the honeycomb, you are certain to find another important substance in the hive. This is bee glue (propolis). Propolis is a very sticky brown material that the bees use for many purposes: holding down the hive lid, covering the inside walls of the hive, fastening frames, strengthening comb, plugging holes, and, sometimes, narrowing the entrance. Field bees gather propolis from various plant buds, picking up such sticky substances as pitch from pine trees.

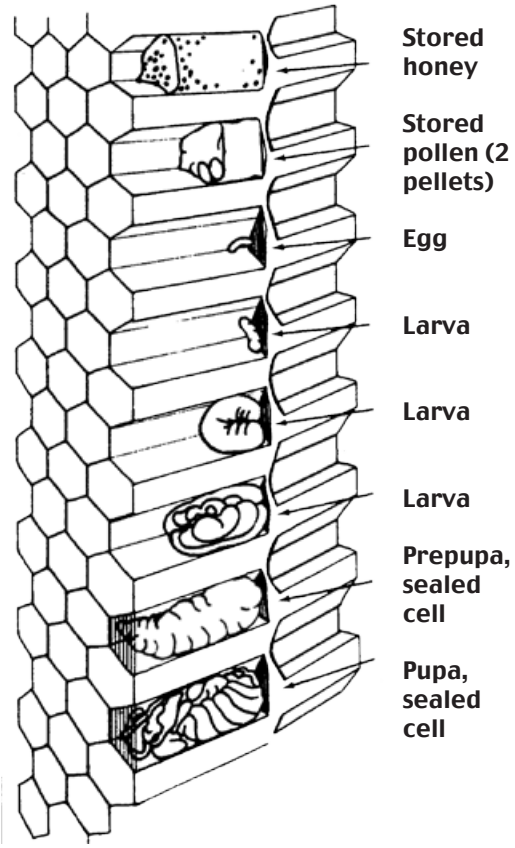
Name three different substances that can be found in the cells of honeycomb.

1. _____

2. _____

3. _____

Figure 6.



Draw a simple picture of honeycomb.

Why is it true that the older the comb is, the darker it is?

_____

_____

_____

Describe how bees build comb.

_____

_____

_____

Why is a drone cell larger than a worker cell?

_____

_____

_____

What is the brood, and where is it found?

_____

_____

_____

Why is the brood area surrounded by pollen storage cells?

_____

_____

_____

Give five uses of propolis.

1. _____

2. _____

3. _____

4. _____

5. _____

Name another substance besides pine pitch that honey bees could probably use as propolis.

_____

Beekeeping Equipment

Now that you have a good basic understanding of honey bees and their activities, you are ready to begin gathering the equipment that you will need to operate your own beehive in Division II. As in any business, you will find that you must make an initial investment to get the equipment to begin beekeeping. However, an advantage of beekeeping is that the amount of equipment you need is limited. And once you have it, assuming that you take good care of it, your later expenses will be small. If you are not sure you are interested enough in beekeeping to purchase your own equipment, you may be able to lease a hive from a beekeeper. Check with your county Extension educator, the bee specialist at Purdue, or the Indiana bee associations listed on the "Purdue University Beehive Website" for referrals to beekeepers who are willing to lease a hive to a 4-H'er. You can find this Web site listed in the Resources section at the end of this manual.

For a good explanation of most of the equipment you will need, read Chapter 2, "Before You Start, Equipment" and Chapter 5, "Your First Honey Flow, Other Equipment" in *The New Starting Right with Bees*.

A valuable tool of the beekeeper is a hive tool. This is a chisel-like instrument slightly curved at one end. It enables the beekeeper to pry up hive lids, supers, or frames glued tightly together with propolis. It is also a handy tool because you can use it as a scraper and a nail puller.

A beekeeper must take care to wear suitable clothing. First, you should have a good pair of leather gloves. This is especially important for the beginning beekeeper until they are experienced enough to know how to work without angering the bees and to know when the bees are unlikely to sting. Many beekeepers prefer special beekeeping gloves that cover the forearm past the elbow. Others like to wear regular gloves along with gauntlets, which are sleeves with elastic in each end extending from the wrist to above the elbow. All the beekeeper's clothing should be white or light in color. It should not be made of rough, wool-like material. Bees are angered by dark-colored and/or fuzzy material, especially if it smells like an animal!

The experienced beekeeper is careful to cover his or her ankles with light-colored socks. Because ankles are on about the same level as a hive entrance, they are often attacked first by angry bees. Even gentle bees may crawl up your pants by mistake!

The experienced beekeeper will fasten down pant legs using bicycle clips, large rubber bands, or string to keep bees from crawling up their pant-legs. Many beekeepers like to wear white coveralls to protect their clothes and to give them added warmth on cooler days in early spring or late autumn.

Beekeeping equipment is available from several convenient sources. There are several bee supply manufacturing companies in neighboring states. Write to one, asking for their current supply catalog and the addresses of equipment dealers in Indiana. (There may be one near you.) From the catalog you can order equipment through the mail. Beekeeping equipment manufacturers are listed at the Purdue University Bee Hive site. See the Resources section for more information.

You will need the following equipment to start your hive:

Item	Number Needed
Bottom board and entrance cleat	1
Hive body and frames	2
Extracting supers with frames	2-3
Foundation	1 sheet per frame
Inner cover	1
Hive cover	1
Queen excluder	1 (optional)
Smoker	1
Bee veil	1
Hive tool	1
Gloves	1 pair
Long sleeve white shirt	1 (recommended)
Overalls	1 (recommended)

Complete the beekeeping inventory to have a record of your purchases.

Observing a Beekeeper

As you read at the beginning of this manual, your best source of information about beekeeping is the experienced beekeeper. Having almost completed Beekeeping I, you now understand enough about the honey bee and the equipment of the beekeeper to know what questions to ask your advisor.

Carefully observe your beekeeper advisor as they check a beehive. Write a description of each step in the process of "going through" a beehive, beginning with the preparation of the necessary equipment—lighting the smoker, putting on the veil, etc.—and ending with the clean-up procedures that follow such work.

Beekeeping Inventory

Date Obtained	Item	Number	Cost
	Total		

What is meant by the term "movable-frame hive"?

_____

_____

_____

What is meant by the term "crossed comb"?

_____

_____

_____

Why is it necessary to have a hive stand, bricks, or something similar to keep the bottom board off the ground?

_____

_____

_____

Explain how the frames are built to maintain the "bee space."

_____

_____

_____

What are the advantages of using comb foundation in your hive?

_____

_____

_____

What is the function of a smoker? Name some materials that would make good smoker fuel by burning slowly with much smoke.

_____

_____

_____

What is the function of the hive tool?

_____

_____

How does a queen excluder work, and what is its purpose?

_____

_____

_____

Explain the various types of clothing a beekeeper must wear when working with hives.

_____

_____

Demonstrations and Talks

Now that you have begun learning about bees, you might want to share your knowledge with others at a 4-H club meeting or county or state fair. An action demonstration is an excellent way to teach others about bees.

Action Demonstration Guidelines

What is an action demonstration or action demo?

An action demo is a fun way to share with others what you have learned in your 4-H project. It's a kind of "show and tell," but with more action. An action demo is not like a regular demonstration, where the audience sits and listens to a prepared talk. An action demo lets the audience get involved.

Action demonstrations can be given anywhere there are a lot of people, such as a county or state fair, shopping mall, street fair, or any 4-H event. Your job as a demonstrator is to interest the audience in your topic so that they stop and learn something new or try their hand at what you are doing.

How do you choose a topic for your action demo?

An action demo can be on almost any subject. The topic should be something that you enjoy and are knowledgeable about. Consider the following questions when choosing a topic:

- Can you complete the action demonstration in 3-5 minutes?
- Can it easily be repeated over and over again to fill the assigned time?
- Is your action demo showing something that would interest the general public?
- Is there a good way to involve your audience in your action demo ("hands-on" or answering questions)?
- Can the supplies for the "hands-on" section be used over and over again, or will they need to be replaced? (Remember, if the materials must be replaced, it will cost more to do the demonstration.)

How can you get the audience involved?

The first thing you need to do is be enthusiastic and attract people's attention as they walk by your table. You might have a colorful tablecloth or poster to spark their interest. You might ask them a question, such as: "Would you like to play this game?" or "Have you ever made pretzels? Would you like to try?" The best way to attract their attention is to have people around your table doing something. People love to do hands-on activities, so once you get a few people at your table, they will attract others. For more information on action demonstrations, see V-4-H-28.

Involve your audience by having them:

- do what you are doing
- do a "hands-on" section
- judge the quality of various items
- play a game
- answer questions

Remember, the key to a good action demo is getting your audience involved.

Action Demo Checklist

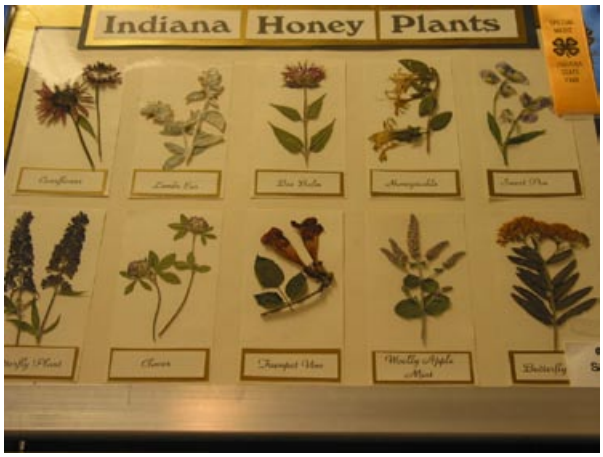
Topic	Yes	No
Was the topic interesting to the general public, causing them to stop, watch, or participate?		
Did the topic stimulate questions from the audience?		
Was the topic of suitable length?		
Did the topic include something "hands-on" for the audience to do?		
Organizing the Content	**Yes**	**No**
Was the topic organized into short "show-and-tell" segments that were done repeatedly?		
Were segments presented in logical order?		
Were segments explained so that the audience understood why?		
Was it evident that the 4-H'er was knowledgeable about the subject and could answer questions?		
Did visuals, pictures, posters, or actual objects clarify the important ideas?		
Presenting the Demonstration	**Yes**	**No**
Did the 4-H'er seem enthusiastic?		
Did the 4-H'er encourage the audience to become involved in the demonstration?		
Did the 4-H'er speak directly to the audience?		
Did the 4-H'er show evidence of practice and experience?		
Did the 4-H'er show that she/he enjoys talking to the audience?		
Did the 4-H'er show enthusiasm, friendliness, and a business-like manner?		
Did the 4-H'er tell about what they learned through this 4-H project?		
Comments:		

Exhibits

You should get information about the 4-H Beekeeping exhibit from your county Extension educator. Indiana State Fair guidelines are available at the 4-H Web site (www.four-h.purdue.edu).

Judges will evaluate your exhibit based on the following items:

1. originality
2. organization of materials
3. accuracy of information
4. interest and value of exhibit
5. depth of knowledge illustrated
6. attractiveness, neatness



Resources

Recommended Book: *The New Starting Right with Bees* (21st Edition)
This book available from the publisher.

A.I. Root
623 West Liberty
Medina, OH 44256
Phone: 800-289-7668

***Bee Hive*, a Purdue University Web site**
There are many beekeeping resources listed at the site:

http://www.entm.purdue.edu/entomology/research/bee/

Choose "getting started" under "Beekeeping Information." You will find links to Indiana beekeeping associations, general information sites, local suppliers, contacts, journals, sources for books, videos, and slides, and more! If you do not have Internet access, check your local library or visit your county Cooperative Extension Service office.

Note: If you do not have access to the Internet you can ask your county Extension educator to help you access this information. Many public libraries also have computers you may use.

Glossary

Afterswarms – Swarms that leave a colony with a virgin queen after a swarm of the same season has already left the hive.

American foulbrood – An extremely contagious disease of bees that affects them in the larval (worm) stage of development; caused by the bacteria *Bacillus larvae*.

Apiary – A collection of colonies of honey bees; also, the yard or place where bees are kept.

Apiculture – Beekeeping.

Bee escape – A device to remove bees from supers or buildings; constructed to allow bees to pass through in one direction but to prevent their return.

Beehive – A box or other structure for housing a colony of honey bees.

Bee space – An open space (1/4 to 3/8 inch) in which bees build no comb and/or deposit a minimum of propolis.

Beeswax – The wax secreted by honey bees from eight glands within the underside of the abdomen and used in building their combs.

Bee veil – A wire screen or cloth enclosure worn over the head and neck for protection from bee stings.

Bottom board – The floor of a beehive.

Box hive – A plain box without movable frames used for housing a colony of honey bees.

Brace comb – Small pieces of comb built between combs and the hive.

Brood – Young developing bees found in their cells in the egg, larval, and pupa stages of development.

Burr comb – Small pieces of wax built upon a comb or upon a wooden part of a hive because more than 3/8 inch space was left.

Castes – The different kinds of adult bees in a colony: workers, drone, and queen.

Cell – A single compartment in a honeycomb in which brood is reared or food is stored.

Chunk honey – A piece or pieces of comb honey packed in a jar with liquid extracted honey.

Clarification – The removal of foreign particles from liquid honey or wax by the straining, filtering, or settling process.

Cluster – The hanging together of a large group of honey bees, one upon another.

Colony – A community of honey bees having a queen, thousands of workers, and, during part of the year, a number of drones.

Comb foundation – Thin sheets of beeswax or plastic used to form a base on which the bees can construct a complete comb of worker cells.

Cut comb honey – Squares of honey in the sealed comb in which it was produced; cut from a shallow super-size frame of sealed honeycomb and then packaged in clear plastic.

Drifting – The return of field bees to colonies other than their own.

Drone – A male honey bee.

Dysentery – A disease of honey bees causing an accumulation of excess waste products that are released in and near the hive.

European foulbrood – An infectious disease affecting honeybees in the larval (worm) stage of development; caused by the bacteria *Streptococcus pluton*.

Extracted honey – Liquid honey.

Extractor – A machine using centrifugal force for removing honey from the comb without destroying the combs.

Field bees – Worker bees, usually at least 10 days old, that leave the hive to collect nectar, pollen, water, and propolis.

Frame – Four strips of wood joined at the end to form a rectangular device for holding honeycomb.

Granulated honey – Honey that has crystallized, changing from a liquid to a solid.

Hive – Worker bees furnished by man. As a verb, to put a swarm in a hive.

Hive body – A single wooden rim or shell that holds a set of frames. When used for the brood nest, it is called a brood chamber. When used above the brood nest for honey storage, it is called a super.

Hive cover – The roof or lid of a hive.

Hive tool – A metal tool with a scraping surface at one end and a blade at the other; used to open hives, pry frames apart, clean hives, etc.

Honeycomb – The mass of six-sided cells of wax built by honey bees in which they rear their young and store their food.

Honey flow – A time when nectar is plentiful and bees produce and store surplus honey.

House bee – A young worker bee, 1 day to 2 weeks old, that works only inside the hive.

Inner cover – A thin wooden board placed just beneath the hive cover for added protection and insulation from the elements, and to keep the hive lid from being glued to the hive body.

Job shadowing – Learning from others by following, watching, and studying what they do in their jobs.

Larva – The grublike or wormlike immature form of the honey bee in its second stage of metamorphosis.

Metamorphosis – The series of changes in form through which an insect passes; egg to larva to pupa to adult.

Movable frame – A frame of comb that can be easily removed from the hive. It is constructed to maintain a proper bee space, which prevents the bees from attaching comb or fastening it too securely with propolis.

Nectar – A sweet liquid secreted by plants, usually in their flowers, and converted into honey by bees.

Nosema – An infectious disease of the adult honey bee that infects the mid-gut, or stomach. It is caused by a protozoan parasite. Symptoms of this disease closely resemble those of dysentery.

Observation hive – A hive made mostly of glass or clear plastic to permit observation of the bees at work.

Pesticide – A general name for materials used to kill undesirable insects, plants, rodents, or other pests.

Pollen – Dustlike grains formed in the flowers of plants in which the male elements are produced. Honey bees use pollen as a protein food for their young.

Proboscis – The tongue of a honey bee.

Propolis – A kind of glue or resin collected by the bees for use in closing up cracks, anchoring hive parts, etc. It is also called bee glue.

Pupa – The third stage of a developing bee, during which it is inactive and sealed in its cell. The adult form is recognizable during this stage.

Queen excluder – A device, usually constructed of wood and wire or sheet zinc, having openings large enough for the passage of worker bees, but too small for the passage of larger drone and queen bees.

Robber bee – A field bee from one colony that takes honey from another colony.

Sacbrood – A slightly contagious disease of brood that is caused by a virus.

Sealed brood – Brood, mostly in the pupa stage, that has been capped or sealed in cells by the bees with a somewhat porous capping of wax.

Section comb honey – Honey in the sealed comb that was produced in thin wooden frames called sections.

Smoker – A device that burns slow-burning fuels to generate smoke for the purpose of keeping the bees calm while working in their hive.

Solar wax extractor – A glass-covered box for melting down beeswax by the heat of the sun.

Super – A receptacle in which bees store surplus honey placed “over” (above) the brood chamber. As a verb, to add supers in expectation of a honey flow.

Swarm – A large group of worker bees, drones, and a queen that leaves the mother colony to establish a new colony.

Travel stain – The darkened appearance on the surface of comb honey when left in the hive for some time; caused by bees tracking propolis over the surface as they walk over the comb.

Uniting – The combining of two or more colonies to form one large colony.

Virgin queen – An unmated queen.

Wax moth – A moth whose larvae feed on and destroy honeycomb.

PURDUE UNIVERSITY

Purdue Extension
Knowledge to Go
1-888-EXT-INFO

Revised 7/06

PURDUE
EXTENSION

4-H-586-W

4–H Beekeeping

Division II

Working with Honey Bees

Year in Project: _____

Date Started in Beekeeping II: _____

Name: _____

Club: _____

County: _____

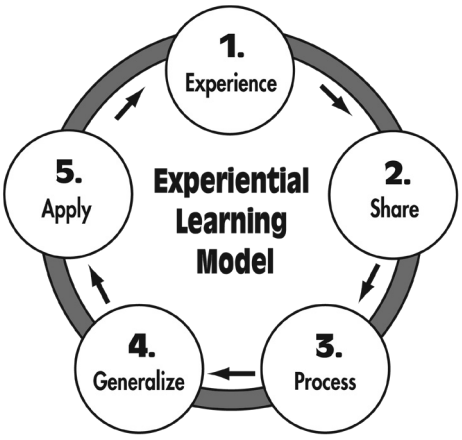
4-H Beekeeping, Division II: Working with Honey Bees

Note to Parents and Volunteer Leaders:

The 4-H Beekeeping project helps youth learn about raising honey bees. Beekeeping offers many exciting educational experiences, from learning about bees and honey plants to learning to raise bees and produce honey.

The 4-H Beekeeping Project is divided into three divisions. Division I, *Understanding the Honey Bee*, covers information on the basic facts of beekeeping: the types of bees, the honey and wax they produce, the plants that attract bees, and the equipment a beekeeper needs. In Division II, *Working with Honey Bees*, youth acquire a colony of bees and learn how to care for their beehive throughout the year. This includes basic beekeeping operations that result in the production of extracted, chunk, or cut comb honey. When the youth are experienced and knowledgeable enough in the basic care of a beehive, they should move on to *Advanced Beekeeping Methods*. The advanced topics include: increasing the number of your honey bee colonies, increasing honey production, producing special kinds of honey, and learning more about the bee societies.

The learning experiences have been planned to initiate "experience centered" activities. Youth are encouraged to take responsibility for their beekeeping projects. They can enhance their learning by consulting resources on the Internet, at school, and at the library, or by talking to someone who raises bees.



Experiential learning distinguishes 4-H youth development education from many formal educational methods. Activities are designed so youth experience a learning activity, reflect on what they did (explore the meaning of the activity), generalize what they learned (to test comprehension and appreciation of the activity), and then think about how they can apply what they learned to other situations (generalize). You can help guide youth as they explore each activity by discussing each section.

Purpose

Division II Beekeeping is intended to help youth learn many things, including:

- how to care for their own beehives,
- more about the equipment that a beekeeper needs,
- how to compile beekeeping records,
- how to present the results of their work to others,
- how to develop inquiring minds—the habit of asking questions and searching for answers.

Purdue University staff who contributed to this publication:

- Natalie Carroll and Greg Hunt
- Reviewers Tom Turpin and Larry Segerlind

Working with Honey Bees

Working with Honey Bees

In Division I Beekeeping you learned about the honey bee and the equipment of the beekeeper from your manual and the book *The New Starting Right with Bees*. If you did not do Division I Beekeeping you might want to review the information in the manual. In Division II, we recommend you subscribe to a Beekeeper magazine such as *American Bee Journal* or *Bee Culture*, and you may want to get the book, *Honey Bee Biology and Beekeeping*. You will care for at least one beehive of your own throughout a full year's cycle of events. It might be better to begin with two hives of bees so you have the back-up resources of the other hive (brood, queen cells, honey, etc.) if something goes wrong with the first one. However, one hive is usually enough for a new beekeeper if keeping two is not possible.

There is a big difference between reading about the bees and actually working with them. When you work with bees, you must show initiative and responsibility if your hive is to succeed. You will have to make decisions about where to place your hive, what kind of bees to work with, and where to get them. You will have to inspect your bees to make certain that they are healthy and remain so. You will have to decide when to feed your bees in the spring and fall, when there is a danger of their swarming, and when it is necessary to "super" the hive. You will have to know how much honey you can take off of the hive and how to extract and market that surplus honey. If you make the right decisions in these situations, your bees will cooperate and produce a good crop of honey for you.

You will have many important decisions to make about your bees during the coming year. You are not expected to answer all of the questions on your own. Beekeepers of many years experience still turn to other beekeepers for advice when they must make difficult decisions. Now that you will have your own hive of bees, it is important for you to keep records and look to your beekeeping advisor for help.

Every beekeeper can vividly recall their first hive of honey bees: the problems, the questions, and the mistakes they made with it. If you turn often to your beekeeping advisor for suggestions, you will probably get answers for problems and questions you have about your first hive and avoid many mistakes that others have made. The first thing to do is to consult a beekeeping supply catalog. Once you have decided what you need, it will be necessary to get your hive parts and frames put together in time for your bees.

NOTE:

This manual, *Working with Honey Bees*, will help guide your beekeeping learning experience, but it's only one of many resources you'll need. Each section gives a brief introduction to a topic, then asks you questions. You will need to use additional resources to learn the things you need to know about beekeeping and to answer many of these questions. Your beekeeping advisors are the best place to start. They can discuss many of the topics with you and show you how to manage a beehive. They probably also have beekeeping books and journals that you can borrow.

If you are starting your own beehive, you should subscribe to a beekeeper magazine such as *American Bee Journal* or *Bee Culture*. Reading a journal helps you learn about beekeeping, current bee problems, and recommended solutions. Journals also will help you answer the questions in this manual. Order information for these and other resources are listed in the back of this manual (Resources). *The New Starting Right with Bees*, which you bought for Division I Beekeeping, will also have much of the information you need to start your beehive and answer the questions in this manual.

This symbol lets you know that you need to use outside resources to answer a particular question.

Selection of Location

The first decision the new beekeeper must make is where to put the hive. There are different factors that make a beehive location successful. There are also other questions about location to consider. For one thing, try to choose a location that is as close to your home as possible. There are several reasons for this. The closer the hive is to your house, the more convenient your storage area will be and the less time you'll spend traveling to and from your hive. If they are nearby, you will be able to inspect them more often.

Occasionally, beehives are vandalized by thoughtless people who find a beehive in an isolated area an irresistible target for rock throwing or shotgun blasts. Therefore, having the beehive closer to your home or the home of some other responsible person provides greater security for the colony.

Nectar

You need to make a careful study of available honey plants around a potential hive location. Honey bees get most of their nectar and pollen within a half-mile radius of their hive location. However, they can travel from one to two miles on their collection trips, depending upon the ruggedness of the terrain and the prevailing winds.

Water

Bees, like all animals, need a constant supply of water. It is best if there is a stream or pond in the vicinity of the beehive. A good source of water is especially necessary if your beehive is to be located close to neighbors' homes. Otherwise, the bees may choose your neighbor's water faucet, the children's wading pool, or the bird bath for a source of water. To avoid having your bees become a nuisance, place a tub or pan of water near the hive, and your bees will learn to go only to that safe "watering hole." Make certain that the water source has something in it the bees can land on without danger of drowning, such as cork floats, bark, or layers of crushed rock.

Drainage

There must be some water near the hive, but not too much. There should never be any possibility of the hive having to sit in water. Therefore, look for a spot with good drainage. Keep the hive off the ground using a hive stand or bricks and tilt it slightly forward. This will permit any moisture that may accumulate to run out the front entrance. Leaning the hive slightly forward also makes it easier for the bees to remove dead bees and other waste materials.

Sunlight

When locating your bees, also consider available sunlight. Your hives should have as much sunlight as possible, especially during the winter months. Face your hive toward the south, where the entrance will have the greatest exposure to sunlight and will be protected from the cold north winds of winter. If your location makes it inconvenient to place the hives facing south, try facing them east to catch the morning sun.

Vegetation

Finally, think about the vegetation immediately around your hive location. Trees to the west or north provide valuable protection from winter winds. You will want to keep the grass and weeds cut around your hive. This will reduce any danger of fire damage and provide good ventilation, which is necessary for the bees to maintain the proper hive temperature.

Name factors to consider when choosing a hive location.

_____

_____

_____

_____

_____

What are the advantages of placing your hive near a stand of trees?

_____

_____

_____

What special considerations must be made by the backyard beekeeper with close neighbors?

_____

_____

_____

Can an area be overpopulated by honey bees? Explain.

_____

_____

_____

Describe a perfect beehive location.

_____

_____

_____

Getting the Bees

Now that you have assembled your equipment and chosen your location, it is time for you to obtain your bees. There are several methods for getting bees to fill your hive: catch a swarm, buy an already established colony, buy a package of bees, or find a beekeeper to sell you a "nucleus" colony. A "nuc" consists of several frames of bees, brood, and honey with a queen.

What equipment do you need to get started in beekeeping?

_____

_____

_____

What is a swarm of honey bees?

_____

_____

_____

Briefly explain the steps in hiving a package of bees.

_____

_____

_____

_____

_____

_____

_____

_____

_____

Why is the queen in a cage when shipped in a package of bees?

_____

_____

_____

Explain the "feeder can" method of feeding sugar syrup to your bees.

_____

_____

_____

There are advantages and disadvantages to each of the methods for getting honey bees. Buying a "nuc" or nucleus colony is one good option if you can find a local beekeeper that sells them. This gives your colony a faster start than if you install a package, because you will already have drawn comb and brood. Also, a locally-bred queen may be better adapted to your weather conditions. Ordering a three-pound "package of bees" is another good method and it avoids some possible brood diseases. The beginning beekeeper learns a lot by observing the process of a package of bees developing into a full strength and producing colony.

Remember, if you plan to order a package of bees, do it soon enough so that it will arrive during April. It is best to start your hive in early April to allow more time for your colony to grow. Send in your package order as early as possible, preferably before the beginning of February. See the References section for more information about sources of bees.

Which race of honey bee do you want to get? Why?

_____

_____

_____

What are the advantages and disadvantages of purchasing an established hive from a beekeeper?

_____

_____

_____

Bee Diseases and Pests

Like people, honey bees can be affected by diseases and pests. Although the types and number of bee diseases are limited, they can be very serious. Table 1, Honey Bee Diseases, Pests, and Medications, lists some of the most comon ones. If you have access to the Internet, go to the Purdue University Bee Hive site and read "Parasitic Mites of Honey Bees." You can also find current information on pests of bees in journals, at beekeeper meetings, and at other sites on the Internet.

Always be aware that your bees could become infected by disease, but the chances are in your favor that they will stay healthy. Nosema disease is more common in Midwestern beehives than most beekeepers realize, but seldom is so serious that the hive is noticeably weakened. However, it can become a serious problem during the winter. American Foulbrood can pose a serious threat to bee hives, but the other brood diseases (European foulbrood, chalkbrood, and sacbrood) are "stress" diseases that usually can be cleared up by re-queening or just feeding sugar syrup. Bee pests include the wax moth, mites, ants, and mice. The Varroa mite is currently the worst problem in beekeeping worldwide. Mice are very destructive during the winter. Reduce the entrance size to decrease damage by mice. Some beekeepers use a 1/4 inch square wire mesh during the fall and winter to prevent entry by mice.

NOTE:

The information and suggestions in the publication are intended to provide guidelines for bee management. Table 1 is included to help you identify possible causes of problems. Control and treatment for some of the diseases and pest of bees may require the use of pesticides. If you think your bees have a disease or pest, ask your advisor for help in determining the cause and solution. It takes expertise and experience to learn about bee diseases and pests. Do not attempt to do this yourself, until you have worked with bees for many years. Use of some pesticides requires certification.

Because of changing laws and regulations, Purdue University Extension assumes no liability for these recommendations. The recommendations for using pesticides included in this guide are incomplete and should not serve as a substitute for pesticide labels. Complete instructions for the use of a specific pesticide are on the pesticide label. The pesticide user is responsible for applying pesticides according to label directions, as well as for problems that may arise through misapplication or misuse of the pesticide. Label changes, product cancellations, and changes in recommendations may have occurred since the publication of this guide. Check with your county Extension agent in agriculture if you are in doubt about a pesticide you plan to use. Trade names have been used in this guide for clarity, but do not constitute an endorsement by Purdue University, nor do they imply discrimination against other products.

Table 1: Honey Bee Diseases, Pests, and Medications

DISEASE	SIGNS	TREATMENT	CAUSE	METHOD
Diarrhea (Nosema)	Brown spots and streaks on hive box where bees come out.	**Fumadil-B** Providing good ventilation really helps!	A protozoan living in the bee's gut: *Nosema apis*	If it is a problem, treat package bees in spring with Fumadil in 1:1 sugar syrup. Treat hives with 2:1 sugar syrup in fall. Nosema can be a problem in winter
American Foulbrood	An uneven pattern of brood with lots of empty cells. Some cell cappings may look darkened and sunken. Cells may be partially opened by bees. Larvae die after cell is capped. You might smell something bad	**Terramycin** Destroy badly infected frames with scales of dead larvae by burning or discard in sealed trash bags.	Bacteria: *Paenobacillus larvae (=Bacillus larvae)*	Not necessary to treat if there is no problem. Watch for symptoms and treat if needed.Sprinkle powdered sugar mixed with Terramycin according to the label instructions (3 treatments, 5 days apart)
Tracheal Mites	No obvious symptoms. Mites that are too small to see are inside the breathing tubes of the bees. In winter, infested bees may crawl out of the hive and die.	**Usually none required.** Some people use menthol crystals.	A mite: *Acarapis woodi*	No treatment needed. Most bees are resistant to tracheal mites. If your bees die in the winter, purchase queens from a different supplier.
Chalkbrood	Dead larvae become white or grey cottony "mummies" inside of cells. Mummies may be seen discarded by bees in front of hive. (cool weather problem)	**Usually none required.** Feed sugar syrup, add more brood or requeen.	A fungus: *Ascosphaera apis*	No drug needed. Chalkbrood often clears up when weather improves or after a new queen is introduced to the hive.
Varroa Mites	Look for Varroa mites in capped cells (especially drone cells) or on adult bees. In bad infestations, you see an uneven pattern of brood with some dead brood. Some bees may have deformed wings. Eventually results in death of the colony, expecially early winter kills.	**Apistan strips** (fluvalinate) **Checkmite+strips** (coumaphos) **Apilife VAR tablets** (contains thymol oil)	A mite: *Varroa destructor (=V.jacobsoni)*	Check for Varroa spring and summer with sticky boards. Checkmite is very effective but is toxic and could harm developing queens. Apilife VAR is less toxic but more labor intensive. <u>This is the one bee disease that must be controlled!</u>
Wax Moths	Webbing in comb. Wax moth larvae bore right through bee brood and comb, leaving lines of dead brood and webbing. Can destroy good comb! This is a problem of weak or dead hives and stored comb.	**PDB moth crystals (Paradichlorobenzene)** are used in stored equipment only. Not moth balls! Bees usually control moths in colonies. Remove dead colonies.	Greater Wax Moth: *Galleria mellonella* is especially attracted to combs containing brood and pollen.	Stack hive bodies or supers and put a piece of newspaper on top. Place 1/3 cup PDB moth crystals on paper above every fourth box. Renew as crystals evaporate. Or kill moths by putting boxes in freezer.

Viral diseases are also important but there is no known effective treatment. Follow all label instructions.

Some bee diseases are highly contagious, spreading very easily and quickly. Even if you are an excellent and conscientious beekeeper with healthy bees, your hives could become infected by the bees from the diseased hives of some other beekeeper who lives several miles away from you.

Explain how honey bee diseases spread from hive to hive.

_____

_____

_____

What are the signs of Nosema disease?

_____

_____

_____

How would you protect your bees from Nosema?

_____

_____

_____

What are the signs of American foulbrood disease?

_____

_____

_____

Describe how American foulbrood can be successfully treated.

_____

_____

_____

What is chalkbrood disease?

_____

_____

_____

How is chalkbrood disease treated?

_____

_____

_____

How would you know if your bees have Varroa mites?

_____

_____

_____

What would you do to treat them for Varroa mites?

_____

_____

_____

What is the best method of avoiding damage by the wax moth?

_____

_____

Beekeepers' Associations

By this time, you have learned the value of asking an experienced beekeeper any questions you have about your hive. Visiting a beekeepers' association meeting gives you the chance to meet other beekeepers, ask questions, and hear about others' ideas about and experiences with honey bees. As you have probably found out, there is nothing a beekeeper likes better than to "talk bees" with anyone!

You can find contact information for beekeeping associations at your Department of Natural Resources Web site and the Purdue Beehive Web site. See the Resources section for more information.

Your area may also have a local beekeepers' association. Such an organization is especially valuable because it offers an opportunity for more frequent meetings and greater cooperation among its members. Check with your beekeeper advisor or the Web sites to see if there is a regional organization near your home.

Seasonal Management Practices

It is important to keep good records. This will help you make decisions in the future and help you organize your beekeeping work. Use the sheets in this manual to help you keep records (inventory, receipts, financial summary, and labor records). You have now progressed to the heart of the 4-H Beekeeping Project: the maintenance of your own hive of bees throughout the year. The activities of your honey bees are determined to a large extent by weather and plant conditions, so it is easy to understand why there is a seasonal pattern to the colony's life. As the seasons change, so does the work of the bees.

Read Chapter 8, "Spring and Summer Management," and Chapter 9, "Late Season Management," in *The New Starting Right with Bees*.

With the first warm days and blossoms of spring, the colony shakes off its winter drowsiness and perks up to begin the hectic work that will ultimately determine the ability of the hive to survive for another year. The interior of the hive is cleaned of winter debris, new comb is built, the queen begins laying eggs at an intense rate, and nectar and pollen are collected to feed the fast-growing population.

The nectar gathering increases in intensity, reaching its peak during the main honey flow of early summer. Throughout the remainder of the summer months, the field and house workers continue their chores of collection, storage, and feeding. Gradually the queen slows her job of egg production.

The bees use the clear, cool days of autumn to prepare for the harsh winter months ahead. The laziness and big appetites of the drones are no longer tolerated, and they are forced out of the hive. The honey supply is centralized in the hive for winter use. The queen limits her egg production even further.

Winter finds the colony clustered tightly together in the center of the hive. There the bees maintain their heat by mutual body warmth and by a very low level of activity, moving only when necessary to get more honey from the nearby storage cells.

You, the beekeeper, must respond to the seasonal needs of your hive. In fact, you need to keep one step ahead of your bees, helping prepare them for the next stage of their annual work cycle. By doing this, it is easier for your bees to work hard and productively.

In the spring, you must make certain that your colony survived the difficult winter months in a healthy, well-fed condition and that it is ready to begin its important spring work. You must decide whether to feed and medicate your hive. You also must make certain that your quickly expanding colony does not become overpopulated and swarm. Sometimes our bees swarm no matter what we do. You can reduce the swarming urge of the bees by providing enough room for your bees and removing queen cells. But don't remove all of the queen cells if the queen is missing or is not laying many eggs!

During the summer, you must always allow your bees enough supers for honey storage. You must help your hive through the hot, dry summer days by providing plenty of supers for storage space and by providing them with proper ventilation. You also must get your honey harvested early enough so that you have time to treat them for Varroa mites.

To help your bees prepare for winter, you will have to make certain that they have sufficient honey and that they are raising healthy brood. These will be the bees that must live all winter long! Also, properly sized hive entrances will keep mice out.

As your bees cluster during the winter months, you will need to prepare your equipment for the beginning of a new season. In the winter, you should stay out of your hive, opening it only briefly in an emergency when temperatures are at least 45 F.

The Beekeeper's Calendar (pages 21 and 22) will help you organize your work.

Summer and Spring

What flowers are important for the bees in your area?

_____

_____

_____

When installing a queen in a hive, why is it important to keep feeding them sugar syrup?

_____

_____

_____

What is "balling the queen," and why does it happen?

_____

_____

_____

List indicators of swarming.

_____

_____

_____

What is a play flight? What behaviors distinguish play flighting from robbing?

_____

_____

_____

Late-Season Management

Why is it important to combine weak colonies with other hives?

_____

_____

_____

Experienced beekeepers recommend making certain that your colony is strong in the autumn so that you will not have to go through it during the winter. Why?

_____

_____

_____

What is important to successfully overwinter your hive?

_____

_____

_____

What are the benefits of top entrances in winter?

_____

_____

_____

Why is it important to monitor food stores in spring or late winter?

_____

_____

_____

Explain the old beekeeper's poem:

A swarm of bees in May
Is worth a load of hay.
A swarm of bees in June
Is worth a silver spoon.
A swarm of bees in July,
Let it fly.

_____

_____

_____

Does a young queen or old queen leave the hive with a swarm?

_____

_____

_____

Why are swarms usually very gentle in nature?

_____

_____

_____

How can a recently hived swarm be encouraged to remain in its new home?

_____

_____

_____

_____

_____

Beekeepers say that if you want some comb foundation drawn out quickly into good frames of honeycomb, give it to a newly hived swarm. Explain.

_____

_____

_____

What is the greatest advantage of using a double brood chamber system as the basic structure of your beehive?

_____

_____

_____

Why is it dangerous to feed your bees in the middle of winter?

_____

_____

_____

Packing of hives is not recommended for Midwestern beehives. Why not?

_____

_____

_____

What method have you chosen to control Varroa mites?

_____

_____

_____

Write a paragraph describing in detail your experience in carrying out each of the following duties of the successful beekeeper:

Spring feeding to stimulate brood production.

Supering and other swarm prevention techniques.

Fall feeding and “taking the hive down” to prepare it for the winter months.

The Beekeeper's Calendar

January

- Perform emergency feeding with sugar candy or dry sugar on top of the inner cover, if necessary.
- Prepare equipment for coming season.

February

- Perform emergency feeding with sugar candy or dry sugar, if necessary.
- Develop an advertising program.
- Order package bees or nucleus hives.
- Prepare equipment for the active season.
- Clean up dead colonies.
- Begin spring feeding toward the end of the month or early in March.

March

- Order package bees and queens needed to replace those that are failing, or to make splits.
- Clean out entrances and bottom boards.
- Continue feeding sugar or syrup if colonies are empty.

April

- Introduce package bees.
- Feed package bees syrup.
- Requeen colonies having failing queens.
- Split strong hives and requeen one half to prevent swarming.
- Reverse hive bodies on two-story colonies where the queen is only laying above.
- Check colonies for American foulbrood and Varroa mites.

May

- Add a super to each strong colony.
- Remove queen cells to prevent swarming (but make sure they haven't swarmed first!).
- Add another super if necessary.
- Provide a ventilation hole.
- Place queen excluder below shallow super on colonies for comb honey.
- Start to rear queens if you want to raise your own.

June

- Remove queen cells to prevent swarming.
- Replace defective combs with full sheets of foundation.
- Provide plenty of super space.
- Split hives to increase the number of colonies, if desired.
- Requeen toward end of month.
- Check colonies for American foul brood and Varroa mites.
- Remove comb honey supers when properly sealed.

July

- Add sufficient super space.

August

- Harvest honey supers when they stop filling up.
- With honey supers off, treat for Varroa mites.
- Extract clover honey.
- Remove section supers.
- Do not work bees too much, to avoid robbing.
- Perform fall requeening.

September

- Provide supers for fall flow, or let bees store it in brood nest.
- Check colonies for American foul brood and Varroa mites.
- Either put empty supers above the inner cover to let bees clean them, or let bees rob from the supers in the bee yard. Then store with PDB moth crystals.

October

- Extract honey from fall flow.
- Put on entrance reducers or mouse guards.

November

- Complete late fall feeding if hives are light.
- Provide top entrance.
- Provide windbreaks.
- Develop a marketing program.

December

- Continue to develop your marketing program.
- Make equipment for extracting, bottling, etc.
- Read bee books.

Extracting Honey

If you learned well and followed the basic principles of beekeeping and if weather conditions were good, your bees should have produced more honey than they will need for the winter. This means you can take some for your own use. Be very careful, though, to leave plenty of honey for the bees to eat during the winter; leave them at least one brood chamber full of honey.

You can use the following method of removing honey from the comb if an extractor is not available and if you extract only a few frames of honey. Realize that this method is only practical for a limited amount of honey and, even then, it means the loss of the reusable comb. Cut the comb from the frame, and mash it in a kettle set in a hot water bath or double boiler. As the comb is gradually heated, the wax will melt and come to the top of the honey. Once the honey and wax are separated, cool the boiler, and lift off the wax. Then strain the honey through cheesecloth and allow it to settle overnight. By morning, it will be ready for bottling. Another method is to simply let the mashed comb strain through a stainless steel screen. This method avoids heating the honey too much, which can affect the flavor and color of your honey.

Certain pieces of equipment are necessary to extract honey properly from the comb. Perhaps you can borrow an extractor from your advisor. Without the proper equipment, extracting honey is a very time-consuming and difficult process. Also, it is inconvenient because, without the use of an extractor, the comb cannot be reused and new comb foundation will have to be provided each year.

If you decide to purchase an extractor, consider purchasing the following equipment:

- honey extractor
- settling tank
- uncapping knife (1 if electric, 2 if not electric)
- cappings scratcher
- jars, storage tins
- cheesecloth or stainless steel strainer

You can get a honey extractor, settling tank, and uncapping knife from any of the manufacturers of beekeeping equipment (see Resources). Purchase jars and tins from these companies, too, if

you choose to use a uniform bottling system. A steel strainer is easy to use. Try to find one that fits over your honey bucket.

What are the advantages of using shallow supers in the production of extracted honey?

_____

_____

_____

How do you know when a frame is ready to be removed from the hive for extraction?

_____

_____

_____

For the beginner, the brushing method of removing bees from comb is recommended. Describe the method.

_____

_____

_____

Explain the purpose of the basic pieces of equipment necessary for the extracting process that you will use for your harvest.

_____

_____

_____

Explain how an extractor removes the honey from the comb.

_____

_____

_____

Explain why it is very important to maintain a weight balance and a steady, moderate speed while using the extractor to spin out the honey.

_____

_____

_____

Explain the statement: “To produce chunk honey, you should use a light brood foundation, not wired. In the production of extracted honey, you should use three-ply foundation wired in the frames, or a plastic foundation.”

_____

_____

_____

Bottling and Marketing Honey

You probably began your beekeeping work because you were interested in the honey bee and you liked outdoor work. However, by now you know there is money to be made in keeping honey bees. Honey is a valuable commodity. Its commercial value is increasing as more and more people realize the benefits of using honey. To make it profitable, a good beekeeper must also be a good business person, knowing how to package the product in an efficient and attractive manner and how to offer it to the public in an appealing way.

Market any surplus honey in one of three forms: extracted honey, chunk honey, or cut comb honey. Chunk honey is a piece of comb honey packed in a jar with liquid or extracted honey. Cut comb honey is a square of comb honey cut from a shallow, super-size frame of sealed honeycomb, then packaged in clear plastic.

This will give you a good background in the methods that can help make your beekeeping hobby a profitable business.

You will need labels for your jars of honey to describe the contents and to tell whose bees produced the honey. These labels should be as attractive as possible. All the bee equipment companies sell a variety of labels with space for you to write or stamp your name and address. Order enough of these labels or, better yet, design your own personalized label and have it printed for your use.

Define clarification of honey.

_____

_____

_____

Honey does not have to be heated before it is sold. What are the advantages and disadvantages of heating your extracted honey? Tell whether you will process your honey by heating it.

_____

_____

_____

Explain the cause of cloudiness in honey and how to avoid it.

_____

_____

_____

Describe several different possibilities for places to give or sell your honey.

_____

_____

_____

Describe in detail your plan for marketing your honey.

Attach or sketch any promotional materials you designed.

Inventory

List all of your beekeeping equipment.

Date Obtained	Item	Number	Cost
		Total:	

Receipts

Date Obtained	Item	Value (Used at Home)	Value (Sold)
	Total:		

Financial Summary

Assets:

Total value of bees, equipment, etc., on hand January 1	
Total value of supplies, equipment, etc., purchased during year	
Miscellaneous expenses (explain) during year	
Total:	

Inventory:

Total value of bees, equipment, etc., on hand December 31	
Total value of bee products available for sale December 31	
Total:	

Total pounds of honey produced:

Value of bee products sold: _____

Yearly profit (or loss) = _____

Assets – Inventory + Value of bee products sold.

_____ - _____ + _____ = _____

Yearly profit/loss: _____

Labor Record

Record all time spent working on your beekeeping project.

Date	Kind of Work	Time Spent
	Total:	

Demonstrations and Talks

Now that you are a working beekeeper, there is much about your craft that you could tell or show others. Use your imagination, and try to remember what fascinated you and what questions you had about honey bees before you began this 4-H project. Below is a list of possible topics for demonstrations or discussions. Use any of these ideas, or choose other interesting aspects of beekeeping to tell others about. An Action Demonstration on one of the following topics is an excellent way to teach others about bees.

- Selection of a good hive location
- "Going through" a hive
- Swarming and catching swarms
- Disease control
- The seasonal management of a beehive
- Extracting honey

Action Demonstration Guidelines

What is an action demonstration action demo?

An action demo is a fun way to share with others what you have learned in your 4-H project. It's a kind of "show and tell" but with more action. An action demo is not like a regular demonstration, where the audience sits and listens to a prepared talk. An action demo lets the audience get involved.

Action demonstrations can be given anywhere there are a lot of people, such as a county or state fair, shopping mall, street fair, or any 4-H event. Your job as a demonstrator is to interest the audience in your topic so that they stop and learn something new or try their hand at what you are doing.

How do I choose a topic for my action demo?

An action demo can be on almost any subject. The topic should be something that you enjoy and are knowledgeable about. Consider the following questions when choosing a topic:

- Can you complete the action demonstration in 3—5 minutes?
- Can it easily be repeated over and over again to fill the assigned time?
- Is your action demo showing something that would interest the general public?
- Is there a good way to involve your audience in your action demo ("hands–on" or answering questions)?
- Can the supplies for the "hands-on" section be used over and over again, or will they need to be replaced? (Remember if the materials must be replaced, it will cost more to do the demonstration.)

How can I get the audience involved?

The first thing you need to do is be enthusiastic and attract people's attention as they walk by your table. You might have a colorful tablecloth or poster to spark their interest. You might ask them a question such as: "Would you like to play this game?" or "Have you ever made pretzels? Would you like to try?" The best way to attract their attention is having people around your table doing something. People love to do hands-on activities, so once you get a few people at your table, they will attract others. For more information on action demonstrations see V-4-H-28.

Involve your audience by having them:

- do what you are doing,
- do a "hands-on" section,
- judge the quality of various items,
- play a game, or
- answer questions.

Remember, the key to a good action demo is getting your audience involved.

Action Demo Checklist

Topic	**Yes**	**No**
Was the topic interesting to the general public, causing them to stop, watch, or participate?		
Did the topic stimulate questions from the audience?		
Was the topic of suitable length?		
Did the topic include something "hands-on" for the audience to do?		
Organizing the Content	**Yes**	**No**
Was the topic organized into short "show-and-tell" segments that were done repeatedly?		
Were segments presented in logical order?		
Were segments explained so that the audience understood why?		
Was it evident that the 4-H'er was knowledgeable about the subject and could answer questions?		
Did visuals, pictures, posters, or actual objects clarify the important ideas?		
Presenting the Demonstration	**Yes**	**No**
Did the 4-H'er seem enthusiastic?		
Did the 4-H'er encourage the audience to become involved in the demonstration?		
Did the 4-H'er speak directly to the audience?		
Did the 4-H'er show evidence of practice and experience?		
Did the 4-H'er show that she/he enjoys talking to the audience?		
Did the 4-H'er show enthusiasm, friendliness, and a business-like manner?		
Did the 4-H'er tell about what they learned through this 4-H project?		
Comments:		

Exhibits

You should get information about the 4-H Beekeeping exhibit from your county Extension educator. Indiana State Fair guidelines are available at the 4-H Web site (www.four-h.purdue.edu).

If you exhibit honey, judges will evaluate its color, body, flavor, uniformity of weight and appearance, clarity, moisture content, crystals, and freedom from contamination. Judges will also evaluate the neatness of the container.

Resources

Recommended Magazines:

American Bee Journal
http://www.dadant.com/journal/
Bee Culture
http://www.beeculture.com/

Recommended Book:

Honey Bee Biology and Beekeeping, by D. M. Caron. Wicwas Press. Cheshire, Connecticut. 1999. ISBN 1-878075-09-8.

Recommended Video:

A Year in the Life of an Apiary, by Keith Delaplane, University of Georgia. 1-800-359-4040
http://www.gactr.uga.edu/tv/videocatalog/bees.html

Purdue University Beehive Website

There are many beekeeping resources listed at the Purdue University Beehive site:
http://www.entm.purdue.edu/Entomology/research/bee/

Choose "getting started" under "Beekeeping Information." You will find links to Indiana beekeeping associations, general information sites, local suppliers, contacts, journals, sources for books, videos, and slides, and more! If you do not have Internet access, check your local library or visit your local Purdue Cooperative Extension Service office.

Note: If you do not have access to the Internet you can ask your county Extension educator to help you access this information. Many public libraries also have computers you may use.

Indiana Department of Natural Resources (IDNR)

The state apiary inspector is employed by the Indiana Department of Natural Resources (IDNR, http://www.in.gov/dnr/), Division of Entomology and Plant Pathology, and is located in Indianapolis. The Apiary News & Information Web site has a variety of information for the beekeeper, http://www.in.gov/dnr/entomolo/apiary/apiarynews.htm.

Topics at the Web site include:

• beekeeping meetings • Indiana apiary regulations • applications for shipping bees and elements of beekeeping into Indiana • assistance for beekeeping in - (State Apiary Inspector, Purdue bee specialist, beekeeping associations, etc.) • plants attractive to native bees • links to Purdue bee publications • links to state and federal programs and services

Glossary

Afterswarms – Swarms that leave a colony with a virgin queen after a swarm of the same season has already left the hive.

American foulbrood – An extremely contagious disease of bees that affects them in the larval (worm) stage of development caused by the bacteria *Bacillus larvae*.

Apiary – A collection of colonies of honey bees; also, the yard or place where bees are kept.

Apiculture – Beekeeping.

Bee escape – A device to remove bees from supers or buildings; constructed to allow bees to pass through in one direction but to prevent their return.

Beehive – A box or other structure for housing a colony of honey bees.

Bee space – An open space (1/4 to 3/8 inch) that permits free passage of a bee but too small to encourage comb building.

Beeswax – The wax secreted by honey bees from eight glands within the underside of the abdomen and used in building their combs.

Bee veil – A wire screen or cloth enclosure worn over the head and neck for protection from bee stings.

Bottom board – The floor of a beehive.

Brace comb – Small pieces of comb built between combs and the hive.

Brood – Young developing bees found in their cells in the egg, larval, and pupal stages of development.

Burr comb – Small pieces of wax built upon a comb or upon a wooden part of a hive but not connected to another comb or part.

Castes – The different kinds of adult bees in a colony: workers, drones, and queen.

Cell – A single compartment in a honeycomb in which brood is reared or food is stored.

Chunk honey – A piece or pieces of comb honey packed in a jar with liquid extracted honey.

Clarification – The removal of foreign particles from liquid honey or wax by the straining, filtering, or settling process.

Cluster – The hanging together of a large group of honey bees, one upon another.

Colony – A community of honey bees having a queen, thousands of workers, and (during part of the year) a number of drones.

Cut comb honey – Squares of honey in the sealed comb in which it was produced; cut from a shallow super size frame of sealed honeycomb and then packaged in clear plastic.

Drifting – The return of field bees to colonies other than their own.

Drone – A male honey bee.

Dysentery – A disease of honey bees causing an accumulation of excess waste products that are released in and near the hive.

European foulbrood – An infectious disease affecting honey bees in the larval (worm) stage of development; caused by the bacteria *Streptococcus pluton.*

Extracted honey – Liquid honey.

Extractor – A machine using centrifugal force for removing honey from the comb without destroying the combs.

Field bees – Worker bees, usually at least 16 days old, that leave the hive to collect nectar, pollen, water, and propolis.

Foundation - Used to form base on which bees can construct complete comb, made of either wax or plastic.

Frame – Four strips of wood joined at the end to form a rectangular device for holding honeycomb.

Granulated honey – Honey that has crystallized, changing from a liquid to a solid.

Hive – Worker bees available for purchase. As a verb, to put a swarm in a hive.

Hive body – A single wooden rim or shell that holds a set of frames. When used for the brood nest, it is called a brood chamber. When used above the brood nest for honey storage, it is called a super.

Hive cover – The roof or lid of a hive.

Hive tool – A metal tool with a scraping surface at one end and a blade at the other; used to open hives, pry frames apart, clean hives, etc.

Honeycomb – The mass of six-sided cells of wax built by honey bees in which they rear their young and store their food.

Honey flow – A time when nectar is plentiful and bees produce and store surplus honey.

House bee – A young worker bee, 1 day to 2 weeks old, that works only inside the hive.

Inner cover – A thin wooden board placed just beneath the hive cover for added protection and insulation from the elements.

Job shadowing – Learning from others by following, watching, and studying what they do in their jobs.

Larva – The grublike or wormlike immature form of the honey bee in its second stage of metamorphosis

Metamorphosis – The series of stages through which an insect passes: egg to larva to pupa to adult.

Movable frame – A frame of comb that can be easily removed from the hive. It is constructed to maintain a proper bee space, which prevents the bees from attaching comb or fastening it too securely with propolis.

Nectar – A sweet liquid secreted by plants, usually in their flowers, and converted into honey by bees.

Nosema – An infectious disease of the adult honey bee that infects the mid-gut, or stomach. It is cause by a protozoan parasite. Symptoms of this disease closely resemble those of dysentery.

Observation hive – A hive made mostly of glass or clear plastic to permit observation of the bees at work.

Pesticide – A general name for materials used to kill undesirable insects, plants, rodents, or other pests.

Pollen – Dustlike grains formed in the flowers of plants in which the male elements are produced. Honey bees use pollen as a protein food for their young.

Proboscis – The tongue of a honey bee.

Propolis – A kind of glue or resin collected by the bees for use in closing up cracks, anchoring hive parts, etc. It is also called bee glue.

Pupa – The third stage of a developing bee, during which it is inactive and sealed in its cell. The adult form is recognizable during this stage.

Queen excluder – A device, usually constructed of wood and wire or sheet zinc, having openings large enough for the passage of worker bees but too small for the passage of larger drone and queen bees.

Robber bee – A field bee from one colony that takes, or tries to take, honey from another colony.

Sacbrood – A slightly contagious disease of brood that is caused by a virus.

Sealed brood – Brood, mostly in the pupa stage, that has been capped or sealed in cells by the bees with a somewhat porous capping of wax.

Section comb honey – Honey in the sealed comb that was produced in thin wooden frames called sections.

Smoker – A device that burns slow-burning fuels to generate smoke for the purpose of keeping the bees calm while working in their hive.

Solar wax extractor – A glass-covered box for melting down beeswax by the heat of the sun.

Super – A receptacle in which bees store surplus honey placed "over" (above) the brood chamber. As a verb, to add supers in expectation of a honey flow.

Supersedure – rearing a new queen to replace the mother queen in the same hive

Swarm – A large group of worker bees, drones, and a queen that leaves the mother colony to establish a new colony.

Travel stain – The darkened appearance on the surface of comb honey when left in the hive for some time; caused by bees tracking propolis over the surface as they walk over the comb.

Uniting – The combining of two or more colonies to form one large colony.

Virgin queen – An unmated queen.

Wax moth – A moth whose larvae feed on and destroy honeycomb.

Feb. 2014

PURDUE UNIVERSITY

PURDUE EXTENSION | LOCAL FACES COUNTLESS CONNECTIONS

Order or download materials at the ***Purdue Extension Education Store*** • ***www.the-education-store.com***