

The document below is public domain

A Queen Manual

This manual was originally written in 2007 by Dana Stahlman for use in the Ohio Queen Project supported by OSBA. The purpose for which it was written has since changed but much of the material in this document applies just as much today as it did when originally written.

Dana Stahlman has given permission for this document to be used by anyone who is teaching queen rearing. It is his hope that it may help beekeepers understand the importance of creating queen lines that are hardy and can survive the rigors of Ohio winters and challenges facing the survival of a hive from one year to the next.

The 2013 Introduction by the author

Evolution has been a hallmark of the survival of any species on the face of the earth. It is reported that more than 99% percent of the creatures created at one time or another in the history of the earth have become extinct.

The honey bee is facing a current crisis of survival in all areas of the world. One can read all kinds of reports concerning the reason for this. However, if left on their own without human intervention with various management techniques nature's natural selection will determine the survival of the species.

There is little humans can do to change the damage being done to the earth by the actions of human progress. Chemicals will continue to be used and don't assume they are something that is not affecting the bees as well as other creatures in our universe. The warning signs are there and arguments vary from one writer to another. There is little the beekeeper can do to change the environment. Our bees must adapt to an environment in which they live (exposure to chemicals, human population growth and the resulting reduction in available land space, changes in land use and agricultural applications to plant production, and the resulting global warming and climate changes).

They live on this planet just as you and me. But you can make a difference. If you find a colony of honey bees that seem to survive in the face of the threat to their survival – mites, weather and even lack of human intervention in their survival, you can learn the process to raise daughter queens from the queen showing the desirable characteristics you see and recognize as being something special.

The methods of raising a queen all rely on the basic fact that honey bees can and do raise new queens all the time. They naturally swarm and propagate each spring if strong enough and conditions permit. They naturally will raise or attempt to raise a queen if for some reason the queen fails or disappears.

You will need to determine the technique you will use to raise future queens. This manual does not contain all the methods in use to raise queens. It is intended to be a starting point to help you decide the action or actions you will take to raise a queen.

It is also written with the hope that those individuals who find that special queen will attempt to raise daughter queens that may carry the genetic characteristics of that queen into future generations of honey bees.

The person looking for immediate success will most likely become discouraged and success depends on hard work and a long term commitment to selecting the qualities that will carry on into future generations of honey bees.

Dana Stahlman London, Ohio 2013

Chapter One

Geographic Conditions affecting the production of Queens in Ohio



Ohio has a total of 41,330 square miles with a population of 11,353,140. As the annual statistics indicate, there were 3224 individual beekeepers registered in 2006 which is the highest number since 1999.

Its highest point is Campbell Hill at 1,549 feet near Bellefontaine. It is approximately 200 + miles North to South and 200 + miles from East to West. The area near Cleveland is in the Lake Erie Snow Belt. Southeast Ohio is located in the foothills of the Appalachian mountain chain. Northwest Ohio is part of the great black swamp. Temperature variations will be found between North and South as well as East and West. These variations are quite noticeable when trees begin to leaf out in the spring. Northern Ohio may be several weeks behind Southern Ohio in the development of nectar and pollen sources. All of these things

affect the ability of beekeepers to raise queens within the state.

To check weather conditions in Ohio I would suggest the following web site:

<http://www.weatherpages.com/ohio/climate.html>.

Ohio temperature extremes have great effects on beekeeping as well. For example, you will all be well aware of the problems we had had in April of 2007. The following chart will list some of these extremes listed by months.....

Ohio: Temperature Extremes

Month	Max.F deg.	Year	Place	Min. F deg.	Year	Place
Jan.	79	1980	Chesapeake	-37	1994	Logan
Feb.	81	1930	Middleport	-39	1899	Milligan
March	96	1907	Portsmouth	-21	1984	Fredericktown
April	97	1925	Portsmouth	-4	1982	Dorset
May	102	1914	Brilliant	17	1968	Toledo
June	108	1934	Germantown	27	1972	Danville
July	113	1934	Gallipolis	34	1988	Cardwell
Aug.	111	1947	Napoleon	27	1982	Canfield
Sept.	107	1953	Philo	23	1928	Peebles
Oct.	99	1884	Ironton	8	1895	Coalton
Nov.	89	1938	Gallipolis	-17	1958	Mansfield
Dec.	80	1982	Chillicothe	-32	1884	Wauseon

Data provided by www.infoplease.com/ipa/A0930238.html

Since we can not raise queens until we have drones, the weather in April is critical to drone production. Cold weather will result in drones forced from the hive and reduced drone production. Reduced drone production by a hive will occur when weather condition such as droughts and reduced nectar collection occur. It is much harder to raise queens when the bees are robbing due to reduced nectar resources.

Due to Ohio’s weather conditions (average), queen rearing will usually begin to take place naturally (swarming) during April and May. Thus, if we are to consider raising queens, we need to be well aware what the weather conditions are for our own locale and we need to plan accordingly.

As a general guide, raising queens is easier when the natural conditions are good for swarming and becomes more difficult when swarming conditions do not exist. In Ohio, it is possible to start grafting in the southern part of the state as early as mid April and have mated queens to sell in early May. For the Northern part of Ohio, these dates can be set back approximately two weeks. In the South (Southern Georgia) grafting usually begins around the middle of February. Queens become available in March. We can not do that in Ohio – Why? Our bees are still in the winter cluster. I might point out that we could have bees raising queens but what is the use if there are no drones for them to mate with when they get ready to mate. Virgin queens can not be banked and saved for a later time to mate because as research has shown, an unmated queen will become a drone layer after a period of approximately 20 days if not mated.

Chapter 2, The development of a virgin queen:

Chapter Two

Queen Biology

Regardless of the method used to raise queens, the process is controlled by facts and principals of honey bee biological development.

Highly recommended reading: *Queen Rearing and Bee Breeding* by Harry H. Laidlaw Jr. and Robert E. Page Jr. Listed price \$30.00.

Basic facts:

- The queen honey bee is an egg layer. Queens, workers, and drones all come from the eggs laid by the queen. A mated queen fertilizes eggs which result in production of eggs which produce worker bees or other queens. Unfertilized eggs produce drones.
- A queen or worker bee’s development depends upon the kind of food fed to the larvae by the worker nurse bees. This food is called royal jelly which is secreted by the glands in the head of the worker bees and royal jelly is continuously fed to larvae destined to be queens.
- Table for development times of egg to adult

Stage	Drone	Worker	Queen
Egg	3	3	3
Larva	6.5	6	5.5
Pupa	14.5	12	7.5
Total	24	21	16

Data from *Rearing Queen Honey Bees* by Roger A. Morse

- Queens are raised by the bees under one of the following conditions....
 - 1) Swarming impulse (Crowded conditions)
 - 2) Emergency replacement of the queen
 - 3) Supersedure replacement of a failing queen.
- Virgin queens will mate with up to 20 drones – usually 12 to 18.
- Mated queens begin egg laying two or three days after the last mating flight.
- The queen retains the navigational ability of worker honey bees and she mates with drones while flying in the open and never in the hive. From *Queen Rearing and Bee Breeding by Laidlaw and Page. Page 31.*
- A drone has no father and is genetically like his mother. The quality of the drone is quite valuable in setting up mating yards because the drone will provide ½ of the genetic material for future queens.
- Drones take 40 days from the time the egg is laid until they reach sexual maturity. 24 days to emerge and another 12-16 days to mature.
- Queen cells must be handled with care. Development can be affected by cold or heat.
- Queen cells can be “candled”. That is one can hold a queen cell up to a light source and see the pupa within the cell. Movement of the pupa can be observed. Vic Thompson, former assistant to Walter Rothenbuhler at Ohio State University taught me a handy technique of taking a sharp knife and making incisions into the side of the queen cell and spreading the wax cell open just slightly for an examination of the larva inside. The cell is then closed as before and the bees will repair the damage and the larva inside will continue to develop into a queen.
- Mature Drones must be present in good numbers if one is to raise good queens. Laidlaw and Page suggest at least 20 drones for each queen to be mated. The person raising queens should encourage drone populations in their hives.

The development of a virgin queen

Every queen begins life as a fertilized egg. The egg will hatch in three days and become a very small larva. At this stage, the honey bees will begin to feed the larva. Depending upon the amount of food given to the larva, it will become a worker or a queen. If we place young larva in a hive without a queen, the bees will try to raise a queen from the larva if no other larva is present. They will feed the new larva royal jelly and to produce good queens the nurse bees need an abundance of pollen and nectar or (sugar syrup).



Our goal is to raise outstanding queens. A queen begins life as an egg.



The egg is almost impossible to remove from a worker cell at this stage. When the egg reaches three days in age, it will begin to lean over and hatch into a small larva at the bottom of its cell.

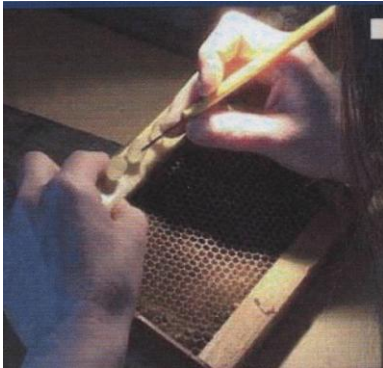


The young larvae grow very quickly. The larvae shown here represent larva ranging from 12 hours to two days in age. If you are using a grafting method, many of these larva are already too large to use for grafting new queens. By the eight or ninth day the worker cells are capped and sealed. The larva by that time fills the entire cell.



This is a picture of honey comb with larvae in various stages. Some of the cells are being capped. Notice the white cells which have not yet been capped.

If we are grafting young larva, we are transferring the larva from its worker cell into a queen cell cup as shown below.



After the transfer the honey bees will begin to feed the young larva with royal jelly and we can see if a larva has been accepted within just a few hours. The nurse bees will reject any injured larva placed in a cell cup and remove it.

Various grafting tools can be used and many grafting experts use home made tools.

This is a technique which takes some time to develop the touch required to get the small larva out of its worker cell.

Malka photo

This is a technique which takes some time to develop the touch required to get the small larva out of its worker cell and moved to the queen cup where the nurse bees will begin the process of feeding the young larva which will develop into a mature queen...(another run on sentence...I have no suggestion, sorry)

The larva should be floating on a bed of royal jelly as shown below.


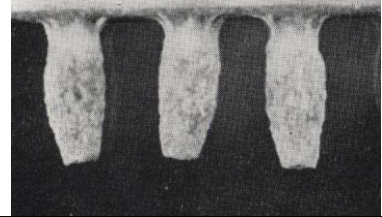
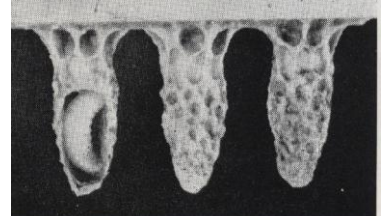



These are well fed four day old larva in grafted queen cells. Note that plastic cell cups are being used in this photo. This is what your grafting efforts should look like after the third day from grafting. Photo provided by the Victorian Government, DEPARTMENT OF PRIMARY INDUSTRIES

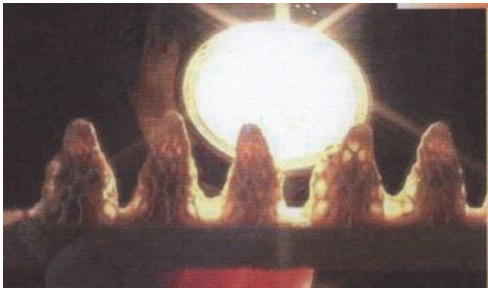
The development of the larva into a pupa is shown in the following table. The pictures are from Queen Rearing by Harry Laidlaw, Jr. and J.E. Eckert published in 1962.



These cells are shown two days following grafting. It is always interesting to see your grafting results and it is safe to remove your grafting frame from the cell builder to see if the grafting effort was successful. In fact, you can see results of nurse bees feeding grafted larva within hours of the graft.

	<p>This picture shows the progress after three days from the grafting date. The cells have been enlarged and not yet sealed.</p>
	<p>This picture shows the progress of the queen cells four days after the graft. They are just about to be sealed.</p>
	<p>This picture shows the progress after six days from the graft. The cells are capped over and the larva is in the pre-pupa stage.</p>
	<p>In the capped cell a number of changes are taking place and that development is shown here. The first cell on the left shows the spinning stage, the middle picture shows the pupal stage, and the right picture shows the completely developed queen prior to emergence.</p>

In the latter stages, the pupa's eyes begin to darken and the last stage is the development of the wings. If for some reason during the last few days of queen development the cell is chilled, the new emerged queen may have undeveloped wings and be unable to fly out of the nuc to be mated. This could happen if there are not enough bees in the nuc to keep the queen cell at the required 90 + degrees temperature required for her final development.



Queen cells can be "candled" to see if movement is detected and the development in the cell is complete prior to placing the queen cells in the nuc's.

These pictures are used with the permission of Martin Braunstein who has developed one of the largest queen rearing companies in the world. (Malka Queens of Argentina)

Malka Photo



If all has gone well, a new virgin queen will emerge from her cell as shown on the left. This occurs at or near the end of the 16th day after the egg has been laid. These young virgin queens are very active and run from light. Young virgin queens seek out any other queens that may be present and try to destroy them. Within three to five days, a virgin queen takes her first mating flight.

Malka Photo

Queen cells should be placed in nuc's prior to the virgin queen's emergence. Honey bees accept queen cells much better than virgin queens.

All young virgin queens must leave the hive to mate. If the queen does not mate, she will end up being a drone laying queen. Thus, a good drone population is necessary to raise good queens. Before queen rearing can begin, a check of hives to determine the existence of an adequate drone population is necessary.



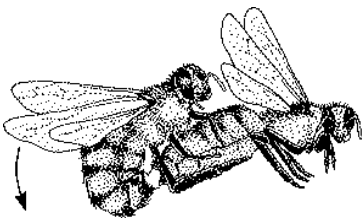
Hives should have some frames with drone cells already capped and some drones present. Capped drone cells indicate a good healthy hive and the drone hives should be selected with the same care that is used to select queen mother hives.

You can encourage drone production by using one or two drone comb in your brood chambers or simply place a frame which has some mouse damage in your drone hive and the bees will build drone comb to fill in the open space.

Malka photo

A final topic in queen biology needs to be discussed: The mating of the queen.

Nature has ensured the survival of the fittest in the honey bee. A virgin queen will leave her hive and mate with a number of drones in the open air and may fly a considerable distance from her hive (p. 32 *Queen Rearing and Bee Breeding* Laidlaw and Page). Successful drones die in the act of mating.



In-breeding is bad for the honey bee unless used with a controlled breeding program; multiple mating encourages more diversity within the hive and the likely success of the colony. The worker bees produced in multiple mating are half sisters (each with the genetic make-up of their mother and different fathers).

Most queen breeders can not place their mating yards in isolated areas. Thus, queens can and do mate with drones from non selected drone mother hives. This is the major problem with open mated queens. Artificial Insemination is used by queen breeders to ensure that only the best mother queens provide the grafting larva needed to improve queen quality. OSBA does have individual members who have acquired that skill and will be sharing outstanding stock for queen mothers in the Queen Project.

Chapter Three

Two Non-grafting Methods for Raising Queens

Introduction: There are many methods used to raise queens. A person raising queens has a number of options depending upon the number of queens to be raised. Experienced queen rearing operations all have variations in the way they raise queens. This is due to the individuals who have developed a preference for a method which has become good for their own application. A beginning queen raiser should be open to various methods. At the end of a period of trial and error, the beekeeper producing queens will develop a style which fits his or her needs.

The Miller Method

This is a non grafting method widely used

Step one: Identify the queen mother hive you are going to use.

Step two: Prepare a frame-- Place a frame of new foundation into the hive that has your queen source (This is your mother queen). This frame is just a regular frame nothing fancy. The comb is cut into "V's". The only thing I would suggest is to place the frame between two frames of brood. Usually foundation is used and it takes a few days for the bees to draw out the foundation and for the queen to begin laying in the comb. Once the queen has laid eggs in the new cells, you will need to prepare a cell building hive.



Step three: The cell building hive is prepared just like all other methods used. I prefer a queenless colony well supplied with sugar syrup, a large population of bees including young bees, and frames with some sealed brood and pollen. If the frames include young larva and eggs, you will need to remove all attempts by the bees to raise emergency queen cells. They will do this at the expense of raising queens from the larva and eggs you provide to them from your selected queen mother.



Step four: Remove the selected frame from the mother hive, shake all the bees from the frame (you could also brush them off), and cut saw tooth fashion into the comb to produce five or six "v" shaped pieces of comb with the young larva or eggs in them. The bees will build queen cells along the edge of the comb rather than using cells on the face of the comb such as the common emergency cell. In Miller's words, "*For a little distance at the edge, the comb contains eggs only. This part is trimmed away, leaving the youngest of the brood at the edge of the comb. One reason for this is that, other things being equal, the bees show a decided preference for building on the edge of a comb. Another reason is that I decidedly prefer to have cells on the edge, thus making them easier to cut out when wanted.*"



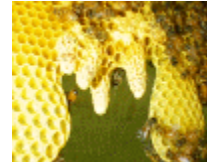
Step five:

You will still need to create a number of nucs for the queens to be raised when the young queens are within several days of emerging from their cells.

Step six:

The completed cells can then be cut from the comb and transferred into your nucs. The queens raised by this method will be as good as queens raised using the Doolittle method.

Usually three or four queen cells will be built by the queens at the junction of the V cuts. These are then cut out and placed into the nuc's. These cells are large, much like the swarm cells. The size and number of cells produced depend upon the number of bees in the cell builder and the amount of feed given to the bees. Of all non grafting methods, this one is inexpensive because you have all the equipment needed and it almost always works.



The Jenter System

The Jenter System frame consist of a box like construction with openings for 110 plastic cells, a compartment the queen is placed in and two lids (front and back). The front lid is removed to expose the queen compartment and the cells where she is expected to place her eggs. The back lid exposes the backside of the cell cups which should hold the young developing larva. In addition one needs cup holders which are fastened to frame bars, cell protectors, and of course the plastic cells to fit the cage for the queen to lay in. The Mann Lake Catalog says, "This system of queen raising is completely graft-less! With this kit, the queen lays her eggs in the cell cup, eliminating the painstaking step of grafting! This system allows you to raise up to 110 queens at one time. All components are reusable except brown cell cups. Reusing cell cups greatly diminishes the acceptance rate." I have had personal experience with this system and consider it expensive and not all that reliable. However, others seem to think it is one of the best systems they have ever used. I feel an obligation to at least share the system with you.



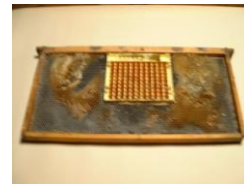
Front side
frame



Cell cup holders



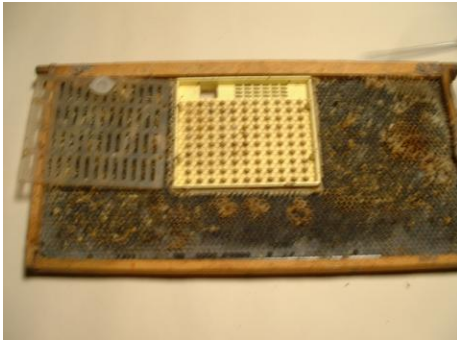
Cell cups



Back side in
frame

In principal this is a good way to get queens without much labor in grafting. However, queens resist laying in the cells and the eggs laid are separated by hours between the earliest egg laid and the last egg laid. Acceptance by cell builders is good if the eggs hatch into larva before being placed in the cell builder. One raising a number of queens will find it inexpensive but for the individual who needs only a few queens, I would recommend the Miller Non grafting method.

In use the cage is placed within the hive – I used a frame with Plastic foundation with



an area cut out for the cage to fit. The honey bees can enter the front compartment of the cage which has openings much like a queen excluder to attend to the queen as well as fed young larva. The cell cups are removed from the back side of the cage and transferred to cell bars with the special cup holders. The hair roller cages and candy cup and closure caps are not really necessary if the beekeeper is transferring the mature queen cells into nuc's before the queens emerge. However, with the wide range of difference in when eggs were laid by the

queen, one might find that an emerging queen will cut down other cells before the beekeeper gets around to removing the queen cells and this could cause some disappointment when you are expecting a number of queens and end up with only one.

Step one:

The mother queen is placed in the cage where she will need to be observed for egg laying activity. Once egg laying by the queen begins, allow the eggs to hatch into young larva before transferring the cell cup to a cell bar. A cell building hive needs to be made up just like in all other methods of queen rearing one or two days before the transfer of cell cups takes place.

Step two:

Cell cups are removed from the back side of the Jenter cage and fastened to a cell bar using the specially designed queen cup holder. These holders are prepared well in advance of this step. The frame holding the cell cups is then placed in the cell builder hive.

Step three:

As in the Doolittle system, which follows in chapter 4, you will need to follow the calendar for transferring the queen cells produced to the nuc's you have prepared. The only difference is that the queen cells produced in the cell builder will most likely vary more in age than the Doolittle grafting method and a close examination of mature cell cells is required. The Jenter system allows the use of a hair roller cage to be placed over queen cells to prevent an early emerging queen from cutting down younger cells. This is the major problem in using the Jenter System.

Comments:

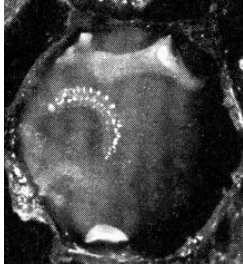
You may be disappointed when you first use the Jenter System. Queens are somewhat reluctant to lay in the plastic cell cups and may take several days before doing so. Nurse bees can pass thru the queen excluder front of the cage to feed and care for young larvae. This is not a system you can put the queen into the cage and four days later move cells directly into your cell building hive. You need to observe the eggs and young larva in the cells. This is often difficult because the device and cell cups are light in color making it hard to see eggs and young larva. However, it is easy to use and is graft-less. If you get 20 to 30 cells from this cage, it is worth the expense to buy. It can be reused except for the brown cell cups.

Chapter Four

The Doolittle Grafting Method

The Doolittle Method of Queen Rearing is the standard method used by most modern professional queen producers in the United States. There are several reasons for this: 1) It is very dependable once the techniques of grafting is learned, 2) scheduling and management of queen production can be easily planned, and 3) the queens produced are of high quality if the cell builder is well supplied with necessary food.

The first step in grafting a young larva (12 to 24 hours old) is to be able to identify the proper age of the larva. When an egg hatches it lies over on its side and is very small. The nurse bees will begin to feed it immediately. It will increase in size very quickly over the next two days. So what you are looking for is a young larva much like that pictured to the left. Note that the larva has not yet reached a complete "C" shape. As the larva grows it will begin to fill the cell – any larva that completely fills the cell is too late in development to raise good queens. One can practice grafting the larger larva and then adjust your skill to the smaller larva. Good eyesight is a must in transferring the larva from its birth cell to an artificial



queen cell cup. Most experts agree that the youngest larva will produce the better queens.

Equipment needed:
Cell Cups



For each larva to be transferred you will need a queen cell cup.

Cell cups can be purchased or made by the beekeeper. Beeswax cell cups are still being sold by several equipment suppliers. The Walter T. Kelley Company sells 200 compressed wax cells for \$3.50. These are usually set into a wood cell cup which allows the safe handling of the

queen cell. The wax cells cups shown in the photo are produced by Rossman's Apiaries and are sold for \$9.50 per pound. These cells are unique and manufactured only by Rossman's. They have a wide base making for easy attachment to cell bars and easy handling of queen cells.

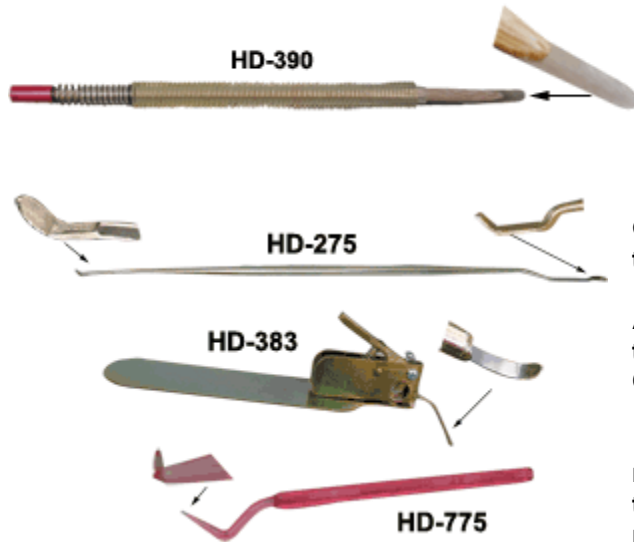


Becoming very popular and just as good as the natural beeswax queen cell cups are various designs made of plastic. Mann Lake sells a number of designs such as the base mount queen cell cup shown on the left. These cell cups will fit into a slot in the top bar or grooved bottom bar.

It is also possible to make your own cell cups. One needs pure beeswax which is heated to the melting point in a container that a specially designed dipping stick is inserted. The dipping stick can be made from a 3/8 inch dowel and the tip is then filed and sanded to form the bottom of a cell and slightly tapered toward the base. The taper is made starting about 1/2 inch from the end of the dowel.

The rounded base should be approximately 5/16 inches in diameter. It helps to soak the dipping stick in soapy water before beginning the cell making process. This allows for the newly created cell cup to slip off the dowel without damage to the cell cup. Only the best clean beeswax should be used.

Grafting Tools



You will need a grafting needle of some type. One of the popular styles is called the Chinese Grafting tool. It is inexpensive (\$3.25 in the Mann Lake Catalog).

Another in popular use is the metal German Grafting tool (\$11.95 also in the Mann Lake Catalog).

Also shown are several other grafting tools you will find in the Mann Lake Catalog.

I often use a grafting tool that I made myself from a paper clip. The key to the use of the needle is the tip which must slide under the young larva without causing injury to the larva.

The larva floats on a small bed of royal jelly and the tip of the grafting tool must be small enough to slide or slip under the larva for it to be picked up and transferred to the cell cup. Many individuals become quite discouraged when their grafting efforts seem to fail. The chief reason for this is damage to the larva during the transfer process and it does take some time to acquire the feel and touch to do it properly. The reason the Chinese tool has become popular is that the tip is flexible and slides under the larva easily and transfers the larva to the cell cup with a nifty spring loading sliding tip which moves the larva off the tip when the spring is released. A good web site to visit to see pictures of the grafting process www.kutikshoney.com/grafting/queens.htm.

A frame to hold the cell cups:



This is a frame to hold cell cup bars. This is from the Brushy Mountain Catalog. One can be easily built from a standard frame and be equally effective.



The cell frame is placed into the cell building hive and holds the queen cell cups until the queen cells are completed by the worker bees. The frame is then removed from the cell builder hive when the queen cells are ready. The cells are then cut from the cell bars and individual queen cells are then ready to place in nuc boxes. A strong cell building hive can feed and create

well over 100's of queen cells as long as it is provided with queen-less young bees and food. It does have a limit on how long it may be used as a cell builder hive. As worker bees age, they do not actively build queen cells. The bees in a queen-less cell building hive can be used to make up the mating nuc's required for queen cells to emerge and the mating process to take place. If you plan on raising a large number of queens check "[Queen Rearing and Bee Breeding](#)". This is available from leading bee equipment suppliers and bee book sellers.

The Cell builder hive: (Sometimes called a starter hive)



The hives shown to the left are cell building hives located in a commercial beekeeping operation (Millay Bee Co.) located in Alabama. Commercial operations sometimes raise thousands of queens in a single day. These hives are being feed with a glass quart jar fit into a hole in the top cover. They are also queen-right which means that each hive in the picture shown has a laying queen. The top super on each of these hives is where the new queen cells are made up by the bees in the hive. The top super is separated from the rest of the hive with

a sliding panel that is removed after the cells are started by the nurse bees. These hives are constantly being fed with sugar syrup.



The equipment needed is much like a standard hive --- hive body, bottom board, inner cover, top cover and a feeder for sugar syrup.

A cell building hive will require a lot of young bees, food, and be in a condition to raise the grafted queen cell cups with young larva into queens. Remember that each queen cell produced by the cell building hive must have a separate small hive of its own in order to survive and mate.

OSBA is recommending queen-less cell building hives because they are easier to work with. You may find that you would prefer a queen-right hive to raise queen cells in and it is entirely possible. It

does require more planning as it is necessary to separate the queen and her phermones from affecting the bees which will start the queen cells.

Mating Nuc's:

Each queen to be raised will require a separate hive or hive with separated compartments. Nuc's are sold in many different sizes and can be constructed easily



by the beekeeper. We recommend standard sized frames but this can be adjusted for the person who wants to raise queens commercially. As indicated earlier, smaller units require much closer attention than larger sized nuc's.

This is a small mini nuc with four half shallow frames. A new queen can easily fill all the available cells in this nuc within several days. The

result is that she and her bees will abscond from the hive leaving it empty except for a few bees.



A standard deep frame nuc of 4 or 5 frame size is preferred for the hobby queen breeder.



Several reasons for this are:

- Standard size frames are available from bee supply dealers.
- All equipment will be interchangeable. Frames can be used in nuc's as well as regular hive bodies.
- Stocking the nuc with deep frames from the brood chamber of established hives is easy. These frames will contain some brood to hold the bees in the nuc.
- When the season is over, frames from the nuc's can be used to build regular hives by combining several strong nuc's or help weak hives.

Procedure:

The first step in using the Doolittle Grafting method is to make sure you have all of the equipment required: cell cups, cell bars & frame, grafting needle (tool), a warm well lit place to do the grafting, a wet towel (warm), and a prepared cell building hive. A warm wet towel is used to protect the grafted cells until they are placed in the cell building hive and it will improve acceptance. If the transferred larva are allowed to dry out which can quickly happen, or become chilled, your efforts will result in a number of misses (queen larva not accepted by the bees).

Step one:



Start the cell builder hive at least one or two days prior to grafting. Your cell builder should be ready to accept new larva given to it. The cell builder hive is a strong queenless hive with a number of nurse bees. It should be fed continuously with sugar syrup/corn syrup and the feeder needs to be kept full even after the cells are placed in the hive. This hive must be checked for any emergency queen cells the bees might have started and they must be removed.

The grafted larva frame needs to be placed in the center of the brood chamber between frames that contain adequate pollen stores, honey, and capped brood. In this hive a frame needs to be removed to make room for the grafting frame. The hive can be a single or double brood chamber hive.

"How to create a cell builder"

The procedure has been provided by Brian Neuman of Newton Falls, Ohio.

Here is one way to do it:

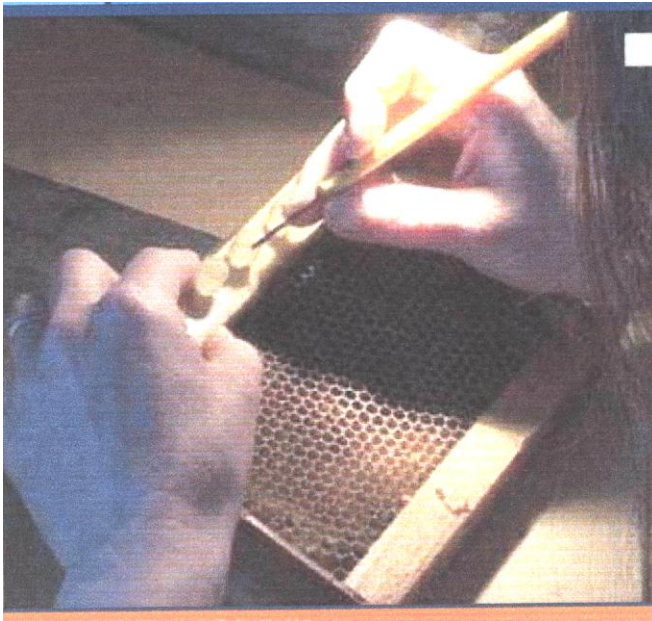
- 1) 2 days before grafting pick one of your strongest colonies.
- 2) Remove the Queen and 2 frames of brood and bees (to start a new hive or nuc)
- 3) Replace the frames with 1 frame of sealed brood from another hive, and 1 frame feeder. Add more young nurse bees if necessary!

- 4) 2 days later check the hive for queen cells and remove them.
- 5) Remove 1 frame no bees (preferably empty brood comb)
- 6) Arrange frames so that the grafting frame is in the center with 1 frame of pollen on one side and one frame of brood on the other.

Step Two:

Select the location where you will be doing the grafting. This can be in a warm lit area either indoors or outdoors. During cool weather it is important to work in an area that is very comfortable to you. If you are cold or chilled, it is too cold to graft in that location. Many commercial queen breeders have a special grafting room or shed. Others use the cab of their truck. It can be done outdoors if the weather is 75 degrees or more. Remember the temperature of the larva inside a hive is near 92 degrees F. The quicker the larvae are transferred the better the results.

You should have a table or solid work surface large enough to hold a frame of young larva and the grafting bar. Back lighting is important for you to see into the bottom of the worker cells that contain the larva. You must feel comfortable with the table height and the reach to the frame that contains the larva and the cell cup bar (the destination of the larvae).



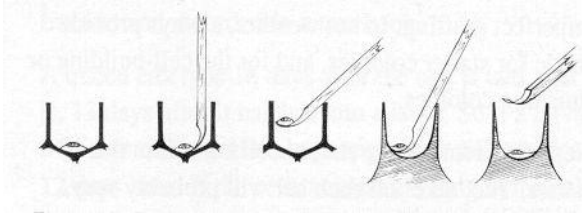
Grafting is a precise exercise in dexterity and firmness. It takes some period of practice to pick up speed and skill. Grafting results are not apparent when the larva is just transferred but within hours, one can determine if the grafting effort was a success or not.

As illustrated to the left, the person doing the grafting is close to the frame holding the larva. The light is positioned over the right shoulder so that the larvae at the bottom of the cells are visible. The grafting bar and cell cups are placed over the frame for easy transfer of the larva. Malka Photo

Step three: Select the frame from which larva will be used for the grafting!

Select only from the best mother queen available. The characteristics of a good mother queen would include: gentle temperament, winter survival, good hygienic behavior, good honey production and any other desirable characteristic you feel is important.

Step Four: Moving the larva to the cell cups.



The frame with the selected larvae is taken to the grafting table for the transfer process. The youngest larvae are removed from the worker cells with a grafting tool and placed in a queen cell cup.

Illustration provided by the Victorian Government, DEPARTMENT OF PRIMARY INDUSTRIES

Step Five: Moving the completed grafted larva to the cell builder hive. Mark your calendar!

Once the cell cups are completed with newly transferred larvae, the frame holding the bars must be placed in the cell builder immediately.

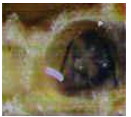






This is a frame being transferred to the cell builder hive. Once the frame is placed into the hive, nurse bees will gather on the frame and begin to feed the young larva. This date must be recorded because regardless of the weather, your schedule, or unexpected events, your new queens will begin to emerge within 11 and at most 12 days from this day. If just one of the new queens emerges before the others you will be left with just one queen.

Step Six: A queen schedule

The development time for a queen from egg to emerged adult is 16 days plus or minus a few hours. There is nothing we can do about changing this time line. Once a queen cell is started, queens will be emerging on what I call the Queen's Schedule. In a hive about to swarm, the queen leaves with the swarm before the young virgin queens emerge. Often some queen cells will be delayed in their start by the bees. Thus the first virgin queens that emerge will try to destroy the oldest queen cells and according to research not tear down the youngest queen cells. It is often that a hive will issue secondary swarms with virgin queens – sometimes several virgin queens in the swarm. The prime swarm will contain the original mother queen. When we use the Doolittle grafting method, or any of the non grafting methods discussed, we are starting with larva already four days old. In the order of things, this means that new queens will be emerging in 12 days from the time of the graft or even earlier if the bees feed larva five days old (3 days as an egg/ 2 days as a larva). The emergence of a young queen from her cell does not take long. Once she begins to cut her way out of the cell, it is only minutes before she emerges. Sometimes the bees in the hive will delay her emergence.

The schedule below is the biological schedule for the development of a queen.

Queen Biological schedule: 				
Egg stage	The Larva	The Pupa	Adult queen cutting her way out of the cell.	Adult Virgin Queen emerges
approx.72 hours (days 1 -3)	approx. 192 hours (days 4-12)	approx. 120 hours (days 12 - 16)	approximately 384 hours (day 16)	approximately 384 hours (day 16)

Using any of the methods we have discussed, the person raising queens must be well aware of the biological time clock for queen development. Most of us will not remember the exact date we started a graft and if we do more than several grafts, it is very difficult to remember exact dates. Several methods can be used to help remember.

- One Keep a notebook with all pertinent information such as the identification of the mother queen that provided the larva and the date of grafting.

An example of an entry could be like the sample below:

Date Grafted	No. of cells	Breeder Queen	Cell bar number	No. of cells accepted	Date Out	Remarks	Number of queens mated

Each grafting frame in a cell building hive should have some identification on it. A code could be used for the Breeder Queen and date of the graft.

Two A card could be placed on the inner cover and protected by the top cover. The card could carry information for just that particular grafting effort. It is not uncommon to see books suggesting various styles of record keeping on cards.

A schedule used to determine when nuc's must be ready for queen cells before they emerge.

This example uses the first day of a month to show the expected emerge date and the expected day the new mated queen will begin laying eggs. The date for the new queen to begin laying eggs will depend upon weather factors such as rain and her ability to mate shortly after emergence.

Sunday	Monday	Tuesday	Wed.	Thur.	Fri.	Saturday
1 Graft date	2	3	4	5	6	7
8	9	10 Nucs to be made up	11 cells must be moved to nuc.	12 Queens begin to emerge.	13	14
15	16	17	18	19	20	21 Queen begins to lay eggs

The beekeeper can determine the number of nuc's required by opening the cell building hive. The queen cell frame can be removed for a short period of time to count the number of queen cells built by the bees. Often the bees will completely cover the queen cells and the beekeeper will need to carefully brush some of the bees away from the cells in order to count them. Do not shake the frame to get the bees off. Any sudden jar or movement could damage the fragile queens in the various stages of development.

Step Seven: Getting Nuc's or Nuclei Ready

Young queens do not tolerate other young queens. If you put two queen cells into a nuc, you will have just one of them survive. Thus you will need equipment for the queens you want to raise. Small hives are called nuclei hives. Some hives will have compartmentalized nuclei from which several queens can live and mate.

Nuc's as I will call them, can easily be made or purchased as discussed above. Generally on the 10th day from grafting, queen cells are harvested. They are removed from the cell builder hive (some queen producers use a finishing hive which we have not discussed), and moved into the nuc's. Nuc's must be stocked with worker bees. These bees will keep the queen cell warm for the period it is in the hive, and provide a work force to feed and take care of the young queen and the eggs she will lay. Some mini nuc's get by with just a cup of bees but to be successful, a five frame nuc with standard deep frames should have at least two frames of bees and brood. The queen cell would be attached to the face of the comb between the two frames of bees and brood. The usual practice is to press the base of the queen cell gently into the face of the comb. This is quite easy with cell cups made of plastic as little damage to the queen cell can take place. Wax queen cell cups are prone to damage if pressed too hard and thus, just enough pressure is needed to make it stay attached. The bees will attach and build wax between the cell and the comb; thus making the cell very secure by the time the queen emerges from the cell.

A good web site to visit to read and see photos of queen bee mating.
http://plantphys.info/Plants_Human/bees/bees.html

Chapter Five

Selling or giving queens away in Ohio

If you are planning on selling queens in Ohio, we must make you aware of the Ohio Apiary Law regarding the selling of queens.

Ohio Apiary Law is contained in Chapter 909 of the Ohio Revised Code. Section 909.08 reads: *“Each person within the state engaged in the rearing of queen bees for sale or gift, before the first day of April of each year, shall file with the director of agriculture a request for the inspection of his apiaries where queen bees are reared. The director shall require all queen rearing apiaries to be inspected at least once each year. If the inspection results in the diagnosis of any serious bee disease or indicates the presence of Africanized honey bees, the owner thereof shall not ship, sell, or give away any queen bees until he has controlled or eradicated the disease or bees to the satisfaction of the director.*

When such diseases or bees have been controlled or eradicated to the queen rearing apiary, or if no serious bee disease is diagnosed or Africanized honey bees are found, the director shall issue a certificate, signed by the state apiarist, a copy of which shall be attached to each package or shipment of queen bees mailed or shipped. The certificate shall be valid for, but not to exceed, one year. The use of tags or other devices bearing an invalid or altered certificate and the misuse of any valid certificate is prohibited.”

You will need to apply for a queen certificate if you intend to give queens away or sell them. At present there is no fee to apply for the Queen Rearing Certificate. You must have your bee yard registered with the Department of Agriculture and pay your bee yard registration fee.

To apply, contact:

Ohio Department of Agriculture
Division of Plant Industry - Apiary
8995 East Main Street
Reynoldsburg, OH 43068-3399
Phone: 614-728-6373

Chapter Six

Selling Queens

There is a ready market for Ohio raised queens. Beekeepers by and large communicate with each other and when they find a reliable source for queens tend to share the good news with others. The opposite is also true -- bad news spreads faster.

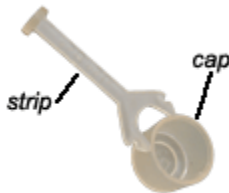
Raising queens is time consuming and the effort requires careful attention to details. OSBA is trying to develop a stock improvement plan for Ohio and the queen stock developed will be shared with beekeepers in the state. Thus, the price charged for queens should be adequate to reimburse the queen producer for time, effort and investment.

Queen cages:

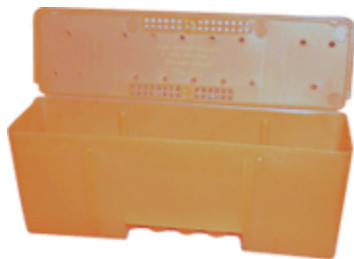
Queens transported to a customer must be placed in a container that will provide protection during the introduction process and provide food for the period the queen will occupy the cage. At present three general types are in use:



This is the JZ BZ plastic queen cage in popular use today. It has a self contained tube which is filled with queen cage candy. We will discuss queen cage candy later in this topic. The tube is filled prior to placing the queen in the cage. Each cage has a latch which opens into the larger body of the cage and the queen and attendants are placed thru this into the cage. When used with candy caps, the cage can be used in bee packages. It can also be used with special battery boxes.



The cap that fits over the candy tube. The strip is placed next to the syrup can in the screened bee package. Some screened bee packages also have a special saw slit for the strip to fit into.



This is the battery box in which queens in the JZ BZ cage can be shipped. It will hold 20 JZ BZ queen cages. A cap is not required with this battery box. Queens in the JZ BZ cage are caged without attendant bees. Queen cage candy is placed in small compartments on both sides of the bottom of this box for the worker bee attendants to feed on. These bees provide the warmth and attention the queen bees will require. The front and back side of the box provide good surfaces for shipping labels and postage. The bottom and top have air vents for good ventilation. This box is also handy for transporting caged queens into the bee yard.



This is the long established three hole Benton Cage. It requires much more labor to prepare these before they can be used. They

include the wooden cage, wire screen wire to be stapled over the holes and a paper square protective cover for the cell that holds the queen cage candy. It requires attendant bees to be placed in the cage with the queen. It uses a larger amount of queen cage candy than the other cages used in the U.S. It is a time consuming task to get these ready for use. Bees travel extremely well in this cage. A number of these cages can be shipped when small strips are stapled to hold them together. The practice in the South where this cage is popular is to ship 26 queens when 25 are ordered. In fact, most queen breeders include from two to four extra queens on orders of 100 or more queens.



by C. F. Koehnen and Sons.

This is the California queen cage. It has one compartment with a plastic tube filled with queen cage candy which allows the queen to be introduced to a new hive. This cage also requires some work to staple on the wire screen and insert the plastic tubes into the wooden container. It does not take up as much room as the Three Hole Benton Cage and can be shipped in a battery box. Usually no attendant bees are put into the cage with the queen. It is sold



Battery boxes for the California cage vary in size and are available from Mann Lake Ltd.

They are called Riteway Queen Shippers. They can be used with the wooden California cage with the cardboard inserts shown in the picture to the left or with the JZ BZ cages. Bee cage candy is placed below the queen cages on wax paper to feed the attendant bees.

Shipping bars for the JZ-BZ queen cages are available for these boxes as well.



Other queen supplies will add to your sales

Marking pens for marking queens



The color code for marking queens is:

Years ending in

0 or 5 = Blue

1 or 6 = White

2 or 7 = Yellow

3 or 8 = Red

4 or 9 = Green

Marks on queens should be placed on the top of the thorax. Avoid getting any paint on the queen's neck. A person who has never done this before might practice by marking drones. A slight firm touch of paint from the marking pen is required.





The queen is usually held between the thumb and forefinger; however, several devices are sold for holding a queen while marking her.

Clipping Queens wing



Some people clip the wings of a queen thinking this will stop swarming. However, it really doesn't stop swarming. The old queen will leave the hive and fall to the ground and often be unable to return to the hive. A young queen will eventually lead a swarm out of the hive. Some individuals also cut either the right or left wing to indicate the age of a queen much like color marks the age of a queen. All valuable queens should be clipped to decrease the chance they will be lost. If a hive is raised above ground level, the clipped queen will often be found under the hive with the swarm where she can be recovered. Never take off more than one half of a wing. Queen breeders usually charge more for clipping a queens wings than for marking with a spot of color. The reason for this is that it is easier to damage a queen during the operation. Check with current queen breeders to see what they are charging.

Queen Banks

Placing queens in a queen bank is a common practice later in the queen season. Queen producers can not produce enough queens in the early spring when demand is high but later the demand drops off and harvested queens must be put somewhere so nuc's can be utilized to their full potential. A queen bank is a colony of bees (either queen-less or queen-right) in which mated queens are placed for a period of time – usually until they are sold. In the queen-less queen bank the queens can be stored almost anywhere in the hive. The queen cages are placed in special frames designed to hold the style of cage the breeder is using. The bees in the hive will feed the queens and keep them alive. A queen-right hive used as a queen bank requires some separation between the brood chamber which holds the queen and the area of the hive where the mated queens are kept. A queen excluder is usually placed over the brood chamber followed by a honey super and then the super that will hold the queen frames. With a queen-right colony this works well until cold weather sets in when the bees will return to the brood chamber and abandon the banked queens. This happens often when beekeepers buy a hundred queens or so and place them directly above the queen excluder until they can get them into hives for splits or requeening. A large number of those queens die because during cold nights etc. the worker bees will leave them unattended.

What is good about a queen bank? It allows the beekeeper to utilize nuc's when queen demand for queens is low or to hold a large inventory of queens after the season has ended.

What is bad about a queen bank? Queens placed in a queen bank are not laying eggs and generally lose weight as a result of not being a productive egg layer. This causes much stress on the queens. It is unnatural for a queen to exist in this condition during the summer months. It may be one of the reasons for a great deal of supercedure in modern queens. The best queens sold are large and placed under stress for a very short period of time – the time from being taken from the nuc until they are introduced to a hive as the queen mother.

Queen Cage Candy

Honey is not used in the formula for making queen cage candy! The reason for this is that honey can contain dormant spores of American foulbrood. Candy made with honey can be a cause of spreading the disease.

Queen cage candy must be soft and pliable for the bees to eat. Rock hard candy is difficult for the bees to consume and bees in the hive may be unable to release the queen from the cage. Queen cage candy is made much like bread dough. The ingredients are powder sugar and numoline. Numoline is inverted sugar syrup used by bakeries. It is usually available in five gallon buckets, however, the Walter T. Kelley company sells it in a 10 pound jar. Check for Cat. No. 258. A ten pound jar will go a long way.

You cannot buy powdered sugar without corn starch. The corn starch is used to prevent the sugar from lumping up. Most packages of powder sugar will indicate 5% corn starch. This does not hurt the bees.

The procedure is quite easy. Pour a two pound bag of powdered sugar into a mixing bowl. I use a Tupperware container with a tight fitting lid. They can be found very cheap at Goodwill or Salvation Army surplus stores. Once the powdered sugar has been poured into the bowl, make a slight depression in the sugar and slowly add a small amount of numoline. If this is your first time making the cage candy, go slow adding the numoline. If you put on a pair of medical gloves you will keep your hands free from the sticky mess you are about to kneed into a soft firm ball. The ball should keep its shape when placed on wax paper. If it sticks to the wax paper or your gloves, you have added too much numoline. If you use it too sticky and soft, the bees in the cage will be smeared and most likely die. You will need to add more powder sugar to make it suitable for use. It is better if prepared just a bit dry rather than a bit sticky.

Another point that needs to be made about queen cage candy is that **heat will cause it to melt**. If queens in a cage are exposed to warm temperatures, the candy begins to run. The result is usually a dead queen. It is easy to determine this has happened if you examine a queen cage and the candy no longer is filling the tube or hole in the cage but rather has slopped into the queen chamber of the cage.

Going into business

Before investing a great deal of money in equipment, find someone who is raising queens and work with or for them. Get an idea of what is involved. \$20.00 dollar queens make it seem as if someone is getting rich. I don't know of any rich beekeepers – queen producers included.



What can be done if you are really serious about queen rearing.

This is Martin Braunstein who owns Malka Queens in Argentina. Visit his site at: www.malkaqueens.com. In Feb. of 1990, he and his wife Sonia traveled to the U.S. where they worked for three large American queen breeding firms. By the mid 1990's they returned to Argentina to start Malka Queens. Malka Queen's produce some of the best queens in the world... Italian (From original stock he got in Italy... Carniolan and Buckfast. Unfortunately, we can not get them in the U.S. Martin is a serious bee book collector and makes frequent trips to major bee meetings both in the U.S. and around the world.

The material contained in this handbook is intended to be used for educational purposes. Some copyright photos have been used with permission and their use is restricted with the agreement that they will not be copied or used outside this document. We have used freely photos from various Queen Supply Catalogs to illustrate queen equipment available for your use. We encourage you to seek out the equipment and supplies they sell for your use.

**Better Bee , Inc.
Brushy Mountain Bee Farm, Inc.
C.F. Koehnen & Sons, Inc.
Dadant & Sons, Inc.
Mann Lake Ltd.,
Rossman Apiaries
The Walter T. Kelley Company**