

## NEW METHOD FOR MATING QUEENS

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### Abstract

It is possible, with proper methodology, to reduce the queen loss during mating to less than 5 percent. Improving several conditions will reduce the mating losses. First, the nutrition of the nucleus colony must be high. Second, mating must take place during the hot season. Third, there must be large numbers of drones present.

Four days after emergence the queen is mature. 90 percent of queens will mate between 7 and 10 days after emergence. In the hot season 90 percent of queens mate between 6 and 8 days after emergence. After 22 days the queen will no longer fly for mating. The first eggs are laid between 8 and 18 days after the queen's emergence. In a normal season 90 percent of the queens lay their first eggs between 12 and 14 days after emergence. In a hot season 90 percent of the queens lay their first eggs between 7 and 9 days after emergence. In our new method the nucleus box that contains a virgin queen is fed 100 grams of a mixture of honey, pollen, water, sugar, royal jelly and lemon juice. The feeding must take place on sunny, hot days, 7 to 10 days after the queen's emergence. With this method 90 percent of the virgin queens will fly twice for mating in a three-day period and the sign of the last mating will be present after the second flight. The time of day for the feeding is important. Queens will fly between 12:00 to 16:00 with 90 percent of the flights taking place between 14:00 and 16:00, therefore, it is important to feed the colony between 13:00 to 14:30.

### Introduction

Mating is an important part of creating a strong, healthy colony. The goal of any queen raising and mating system is to produce good queens that will produce strong

populations. This will not happen without a good mating system. Likewise a selection strategy must include a carefully controlled mating system. There are four main causes of poor mating:

1. bad weather,
2. poor nutrition in the father line hives or mating hives during the mating period,
3. too few drones, or
4. drones that are too young.

Poor mating conditions can lead to: queens that are quickly superceded, queens that are drone layers, or queens that produce poor quality bees or bees with weak immune systems. Some beekeepers miss the opportunity to duplicate their successful hives because they do not have a proper mating system.

Any mating system must include materials and methods that are scalable. In order to be scalable a system must be able to increase the amount of mating without increasing the material, time or cost by the same proportion. The nucleus box mating hive and father-line hives system described below meets that criterion.

## Materials

**Nucleus Box Mating Hive:** Beekeepers and Queen Breeders throughout the world use many different types of mating boxes and often the construction of these hives is a reflection of the individual's experience and personal taste. Our investigative teams have, over the years, worked with many different systems with equal success, but two basic criteria that must be satisfied. One, the mating boxes must be colourful and each box must be uniquely coloured to insure that the queens will return to their home hive. Two, the mating hive layout in the mating yard must create a unique geometric pattern that guides each flying queen home to her original hive. Two basic types of mating hives used by this author are described below.

### Type One: A Three-Compartment Nucleus Box

The type one mating hive is a standard dadant box that has been partitioned into three compartments. Each compartment contains three frames and each compartment has its own entrance. The outer compartments have an entrance on one end and the center compartment has an entrance on the opposite end.

### Type Two: A Single Compartment Standard Nucleus Box

A six-frame dadant nucleus box with one entrance can be used if the beekeeper is prepared to use one box for each queen to be mated.

### Father Line Hive

The father line hive is a standard box that is placed in the mating yard and houses the drones. This hive will be more clearly explained in the Methods section of this paper.

**Caspian Solution:** a blend of royal jelly, pheromones and other all-natural ingredients. Pollen, honey, sugar, water and lemon juice.

## Methods

The method described uses the type one nucleus box mating hive. The method described below is not from a single season or experiment, but a report that summarizes years of using this procedure.

1. Preparation for mating begins as early March when the development of the first drone brood begins. At this time a selection hive is chosen and the nutrition level (protein) in this hive is elevated by feeding the colony Caspian Solution mixed with pollen, honey, sugar and water. This hive receives the supplement twice per week.
  - 1.1. In the selection hive one frame of drone comb is added between two frames of brood. In a well-nourished hive the queen will quickly fill this comb with drone eggs.
  - 1.2. To continue the drone production in the selection hive remove the drone eggs from the selection hive and place them in any strong hive that has been fed the mixture of Caspian Solution, pollen, honey, sugar and water.
  - 1.3. Replace the drone comb in the selection hive and repeat the process. This is drone larvae management.
  - 1.4. While it is very important to have early season drones, some beekeepers that are producing drones for this first time may have difficulty in March in which case they should wait for warmer weather. This advice suggests that queens lay drone eggs because of warm weather, but this author has discovered that this piece of conventional wisdom is incorrect. Queens lay drone eggs because of the nutrition level in the colony not the temperature. Delaying the drone development program may cause another problem as queens that have started to lay worker eggs may have difficulty producing drone eggs.
2. Well before the mating season, dadant supers are added to a standard hive.
3. When the queen lays eggs all of the dadant brood frames complete with the population are removed and one of these frames is placed in each compartment of the nucleus box mating hives. Typically the dadant supers yield seven frames of brood; therefore, each dadant super yields two and one third mating hives.
4. In each of the three compartments of the mating hive a frame with empty comb is added and each of those frames is filled with Caspian Solution mixed with pollen, honey, sugar, water and lemon juice.
5. Fill each of the three compartments in the mating hive by adding one honey / pollen frame. Now each mating hive contains three frames in each of three compartments.
6. Prior to setting up the mating hives in the mating yard, father-line hives are established in the mating yard. Father-line hives are strong colonies that have no queens. The father-line hives are positioned with one frame of drone brood in a standard box and then a frame of drone brood from the selection hive is added every fourteen days. For every 50 mating hives there is one father-line hive.
7. Table One illustrates the most conservative lead-time required in order to have healthy, mature drones available for queens that fly under normal or hot conditions. As a general guideline the drones must be fully emerged when grafting begins, but as Table One shows, an even greater lead-time is advisable.

8. The nutrition levels in the father-line hives is kept very high, if this condition is not maintained the drones will leave. The father-line hives are fed twice per week for the duration of the preparatory and mating period.
9. Some drones will drift from the father-line hives to the mating hives, therefore, the nutrition level in the mating hives must be kept high.
10. As the time of the first mating flights approaches, attention to the weather and the timing of each feeding is critical. Repeated observations in both Iran and Canada have found that 95% to 100% of the queens will fly and be mated between 7 and 10 days after their emergence under normal conditions. The term normal conditions describe typical weather for the region and no special feeding regimen for the mating hive. Under these conditions most queens will be laying their first eggs 14 days after their emergence.
11. There is a unique and optimum condition that presents itself in most mating seasons and that is the opportunity to feed the mating hive at the correct time on hot days to achieve accelerated results. In British Columbia, Canada most of the hot days occur in July, August and early September. Queens will fly between 12:00 to 16:00 with 90 percent of the flights taking place between 14:00 and 16:00. Repeated trials have proven that feeding the hive Caspian Solution mixed with pollen, honey, sugar, water and lemon juice on hot days between 13:00 and 14:30 will lead to 100% mating success in just two days. The hot weather and the supplement stimulate the queens to fly between 6 and 8 days after emergence. All of the queens mated in this way will lay their first eggs between 9 and 12 days after emergence.
12. Under normal conditions queens will make an average of ten flights for mating success. There is significant variation in this behaviour with some mating concluding after one flight and other queens flying 12 to 14 times. Some flights are over after 3 minutes and other queens remain aloft for one half hour. With the supplement and the correct timing of the supplement application more than 90% of the queens complete their mating in three flights.
13. Breeders cannot control the weather, therefore, the stimulative effect of hot weather may not always be available, but the supplement improves the mating process regardless of the weather conditions.
14. Flying and mating behaviours are strongly influenced by genetics, therefore, beekeepers must make careful observations in their mating yards to refine their understanding of their bees.

## Results

In order to explain the methods in detail most of the results have been included in the method section, but a summary of the results is presented below.

1. Well-nourished father-line hives with drones that have been prepared well in advance of the queen larvae grafting guarantees a large population of mature drones with the correct lineage.
2. Proper feeding of the father-line hives insures that the drones do not leave.

3. Hot weather supplement feeding between 13:00 and 14:30 moves the mating flights forward by one day and reduces the time required for 100% mating success from 3 days to 2 days.
4. 90% of the queens reduce the number of flights required for mating from 3 to 10 flights to 1 to 3 flights.
5. Queens begin laying eggs sooner when this methodology is used, therefore, there will be more nurse bees in the mating hives.
6. The gains create a compounded improvement by reducing the risk to the queens and drastically reducing the mating losses. Mating losses in the author's mating yards are consistently less than 5%.

## Discussion

Most papers written by our investigative teams stress the importance of nutrition in beekeeping and this paper is no exception. Nutrition, particularly the feeding of nutritional supplements, might seem unrelated to the mating process and beekeepers might conclude that the health of the drones and virgin queens that enter the mating yard is predetermined and unalterable. Fortunately the application of the correct supplement at the correct time can significantly improve the success of the mating and reduce the queen losses. The following conclusions are supported by observations made for more than 15 years.

1. Nutrition aids bee procreation. The royal jelly and pheromone supplement when thoroughly mixed with honey, pollen and sugar stimulates workers in the father-line and mating hives to take in protein and provides that protein in a form that is quickly and easily ingested. Protein potential in the workers creates more jelly for queens and drones and this improves mating.
2. Conversely, malnutrition causes large losses of queens during mating.
3. Nutrition keeps the population of the drones in the mating yard high.
4. Preparation of the father-line drone population provides large numbers of mature drones at the ideal time for the queens.
5. Lemon juice contains vitamin C that strengthens and stimulates the queens, drones and workers during mating.
6. The citric acid in the lemon juice lowers the pH in the liquid supplement. The lowered pH also stimulates the mating process and all activity in the colony.
7. If a beekeeper can introduce the correct supplement on the optimum day at the ideal time during a temperature peak the improvement in mating is profound. Only the weather is beyond the control of a beekeeper and in this case feeding the correct supplement on the optimum day at the ideal time during a period of normal temperatures will still yield significant improvements in the efficiency of mating.

Table

Table One - Maturation of Drones and Queens		
Days After Drone Eggs Laid	Drones Emerge	Drones Mature
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Days After Drone Eggs Laid	Drones Emerge	Drones Mature	Days After Queen Eggs Laid	New Queens Emerge	New Queens Mature	New Queens First Mating	New Queens Lay First Eggs	New Queens First Mating In Hot Weather	New Queens Lay First Eggs In Hot Weather
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2			2						
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