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# Drone mother colonies – numbers and positioning

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## Introduction

This paper provides information on the numbers and positioning of drone mother colonies supplying drones to queen bee mating apiaries. This basic information applies to commercial queen bee production and to beekeepers who are producing queen bees for their own use.

Obtaining adequately mated queen bees in commercial mating apiaries is one of the important procedures required to produce queen bees with a long fertile life. This part of the queen bee production procedure requires careful management by the queen bee breeder in providing sufficient numbers of drones of a suitable age in the same area at the same time that virgin queen bees are on their mating flights.

Research in eastern Australia has shown that the number of sperm stored in a queen bee's spermatheca after mating may be below the 4.5 million sperm/queen considered adequate for a commercially reared queen bee. Studies have shown the problem to be more prevalent in queen bees mated in early spring than in queen bees mated in early autumn. A similar problem has also been identified in late autumn when low numbers of mature drones are present.

One approach to reducing the problem is for the queen bee breeder to increase the numbers of mature drones in queen mating areas by improved management of drone mother colonies.

A drone mother colony is a colony of bees headed by a queen from a proven commercial line of bees and managed by the beekeeper to produce the maximum number of healthy, well nourished drones to mate with virgin queen bees from a nearby queen mating apiary.

## Number of drone mother colonies

An exact number of drone mother colonies for a set number of mating nuclei under specified field conditions cannot be recommended but somewhere between 4 and 10 drone mother colonies are required for each 100 mating nuclei, as discussed below.

Under ideal conditions, drone mother colonies managed for the production of drone bees would produce and retain the maximum number of drone adults and brood, and all drones would be available to mate with queen bees from the mating apiary.

In this situation two drone mother colonies for each 100 mating nuclei would be sufficient.

However, ideal conditions rarely occur and the minimum number of 2 colonies needs to be multiplied by a factor of between 2 and 5. This is to compensate for colonies not producing maximum numbers of drones on a regular basis, for colonies not retaining adult drones at all times, and for situations where not all of the available drones are flying to the areas to where the queen bees from the mating apiary are flying. Hence the figure of 4–10 drone mother colonies for each 100 mating nuclei.

## Number and age of drones required

Between 12 and 18 drones aged between 16 and 28 days of age are required to mate with each queen bee at the time of mating; an apiary containing

100 mating nuclei would require a minimum of 1200 mature drones to mate with the queen bees from that apiary.

About 6000 mature drones need to be in the general area where the 100 queen bees are mating during the few days that mating takes place to ensure that each queen bee mated with a minimum of 12 drones.

Drone brood survival is low, with about 57% of drone eggs surviving to produce adult drones. To obtain 1200 drones requires about 2400 drone eggs to be laid, the equivalent of two-thirds of one full-depth Langstroth frame fully laid on both sides.

Drones are not able to mate until about 16 days of age.

To provide mature drones at the same time that virgin queen bees are ready to mate, drone combs need to be fully laid with eggs at least 23 days before the first queen cells are grafted.

To produce continuous generations of drones, it is advisable to introduce half of the number of drone combs into drone mother colonies in time to have drone eggs 23 days before the first graft. The remaining drone combs are introduced 14 days after the first drone combs were introduced.

## Position of drone mother colonies

Best mating success has been reported when drone mother colonies are placed 2 to 2.5 km away from the queen mating apiary. In Europe, queen bees were found to mate up to 5 km from their mating apiary with an average distance of 2 km from the apiary. However, when no other source of drones was available, queen bees mated with drones from drone mother colonies placed 300 m from queen mating apiaries.

Due to insufficient information it is not possible to recommend exactly where drone mother colonies should be positioned in relation to the queen mating apiary, but one recommendation is to distribute drone mother colonies in more than one apiary site at distances of 2.5 km around the queen mating apiary.

Supplying more than the required number of drones to the mating area will increase the chances of the queen bees mating with the selected drones but it will not guarantee that adequate mating has occurred, either with the selected drones or with other drones in the area.

## To determine whether queen bees are adequately mated

Adequate mating can only be verified by taking a sample of newly mated queen bees from each mating apiary and having them examined in a laboratory to determine sperm counts in their spermathecae. This procedure would need to be repeated each season if drone population numbers fluctuate.

An adequately mated queen bee is considered to contain 4.5 million sperm or higher. There will always be a range of sperm counts, with some proportion below the accepted minimum, so a cut-off point is required where the decision is taken that queen bees in a particular mating apiary are adequately mated.

A figure of 70% of all queen bees sampled containing 4.5 million sperm/queen or higher is suggested as a minimum standard for determining queen bee mating success at each mating apiary.

Based on available data, with a sample size of 10% (e.g. 10 queen bees randomly selected from a queen mating apiary containing 100 mating nuclei), to ensure that a minimum of 70% of the queen bees in the mating apiary contain a minimum of 4.5 million sperm/queen, the average sperm count for the 10 queen bees sampled would need to be at least 5.4 million sperm/queen. (A queen bee with a fully developed spermatheca is able to contain around 7 million sperm in her spermatheca when fully mated.)

## Procedure

- For a batch of newly mated queen bees caught at the mating apiary to be tested, randomly select 10% of the queen bees and send them to a laboratory able to carry out sperm count examinations.
- Total the results from the examinations and divide by the number of queen bees in the sample to give the average sperm count for the number of queen bees examined.
- If the average sperm count is 5.4 million per queen or higher then it is reasonable to accept that adequate mating occurred at that apiary site on the date the sample was collected.

## Drone congregation areas

Studies in Europe and the USA have shown that drones congregate in specific aerial locations day after day and year after year. In these ‘drone congregation areas’ (DCAs) drones fly 40–60 m high in the air compared with the 12–20 m normal flight height for drones. Honey bees in Australia are the same species and it is probable that similar DCAs occur in Australia.

## Conclusion

The question with positioning drone mother colonies to supply drones for a specific queen mating apiary is whether the drones and the queen bees fly to the same or different DCAs to mate. If sufficient numbers of mature drones are being provided and it has been established by spermathecal counts that adequate mating is not occurring, then sperm counts of queen bees in each mating apiary can be improved by changing the position of apiary sites of mating nuclei and/or drone mother colonies and by increasing the number of drone mother colonies.

## Laboratory able to carry out spermathecal counts

School of Biological Sciences
University of Sydney
Parramatta Road
Sydney NSW 2006.

Cost is about $15 per queen. Contact Dr Ben Oldroyd, phone (02) 9351 7501 to discuss delivery arrangements and current costs before delivery of the queen bee sample.

## Further reading

Agnote DAI/112, *Drone honey bees – rearing and maintenance*
Agnote DAI/113, *Drone mother stock – selection and quality*

## Bibliography


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