Overwintered Honey Bee Nucleus Colonies: Big Solutions in Small Packages

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Beekeepers lose colonies every year. This reduces pollination income and honey production and increases the cost of re-establishing lost colonies. Beekeepers can minimize lost colonies by using good management practices; however, one important practice is to establish nucleus colonies (nucs) during the active bee foraging season. Overwintered nucs provide quick resolution for many beekeeping problems, are available when mated queens and bee packages are not commercially available, and can provide a valuable source of revenue. With proper use, nucs can help mitigate colony losses and increase economic resilience for both commercial and backyard beekeepers, farmers, and the economy at large.

A nucleus colony is a small, portable, honey bee colony (Figure 1). Most nucleus colonies consist of 3 to 5 deep frames, although 6-frame medium or western nucs can be made for beekeepers using only medium or western-sized hive bodies.

Figure 1. A nucleus colony or "nuc"

Photo: Harry Vanderpool

Benefits of Overwintered Nucs

Overwintered nuclei can minimize colony losses by:

Correcting queen issues

The Bee Informed Partnership (https://beeinformed.org/), a national Extension program focusing on developing best management practices to reduce colony losses, has found that queen events are a major contributor to short-term colony mortality. A "queen event" may be defined as a loss of a queen due to injury, departure of the queen with a swarm, or a poorly performing queen in need of replacement. Nucleus colonies can be combined directly with queenless colonies to correct the problem. Because the nuc contains an accepted queen, the typical, caged-queen introduction process can be bypassed with the introduction of a nuc into a queenless hive. This process can be used to correct laying worker colonies and those with drone-laying, injured, or otherwise underperforming queens.

The following are some benefits of using a nucleus colony to correct a queen issue:

- Colonies made queenright via introduction of a nuc do not sustain queenless or broodless

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periods that ultimately diminish adult populations.

- The risk of queen rejection is minimal compared to introduction of a new, caged queen.
- Beekeepers establishing nucleus colonies in late spring and summer can purchase queens when they are readily available, well-mated, and reasonably priced.
- A queen from an overwintered nuc has been proven. The beekeeper has had the opportunity to assess her egg-laying pattern and fecundity.
- The beekeeper is not obligated to return to the apiary to release a queen from the cage or check the status of an introduced queen.

Boosting weak colonies

Nucleus colonies can be directly installed into colonies that are weak or undersized. This boost is especially helpful in high-stakes situations such as when beekeepers are preparing to fulfill pollination contracts or when bees are vigorously foraging during a nectar flow.

Note: Nucs cannot be used to correct *Varroa* mite issues or American Foulbrood. Before attempting to combine a nucleus colony with a weak hive, the beekeeper should identify and correct the source of the problem.

Repopulating dead-outs (dead colonies)

Nucs can be utilized during springtime to restart hives that failed in the previous fall or winter. Beekeepers fulfilling pollination contracts in early spring can also repopulate hives by the introduction of nucs, elevating new hives to adequate strength.

Additional source of income

Unused nucleus colonies can be sold to other beekeepers, creating an additional source of income and providing a valuable service to the beekeeping community. As with any bee transaction, it is critical to ensure the nucleus colonies are free of disease and

Figure 2. Eight nucleus colonies ready for winter
Photo: Harry Vanderpool

are not heavily infested with *Varroa* mites before they are purchased by another beekeeper.

Creating Nucleus Colonies For Overwintering

Nucs made from diseased or infested colonies will acquire the problems of the donor colony or colonies. Thus, they should only be established from strong, healthy donor colonies (Figure 2). The donor colony should have no signs of disease, and the *Varroa* mite levels should be below the treatment threshold of 3 to 5 percent infestation.

Before assembling a nuc, prepare the following:

- Nucleus hive box with additional feeder top and a 1-inch ventilation hole covered with #8 hardware cloth on each of the short sides of the box
- Appropriate number of empty frames as needed to fill the nucleus box
- If necessary, some means of reducing the entrance to the nuc. The recommended entrance is 1¼ inches wide and 5⁄16 inches high

Note: If making nucs early in the year, feeding the donor colony 6 weeks before making the nuc will help the colony gain the necessary food stores and population strength. A single nuc may be created from two or more colonies if colony populations are

not high enough to provide adequate resources for a nuc. Conversely, if populations in a single colony are extremely high, multiple nucs can often be made from the same colony.

Nucleus Colony Establishment Formulas

Honey bee populations fluctuate rapidly with the timing of the primary nectar flow. We present formulas for establishing nucleus colonies based on a peak nectar flow on June 20 (in western Oregon and Washington, the primary nectar source is blackberry, which peaks around June 20). If the nectar flow peaks at a different time in your area, adjust the dates accordingly. Colony divisions will be more successful prior to a nectar flow.

These formulas assume a five-frame, deep-style nuc box. As frames are removed from the donor colonies, they should be replaced with empty frames. The removed frames from the donor colony will be placed into positions 1 through 5 in the nuc box as described below for each start date.

Caution: Take care not to accidentally include the queen from the donor hive in the nuc. For best results, find the frame with the queen and set it aside in a separate, empty nuc box while you are establishing the nucleus hive.

May 20: Before the beginning of the primary nectar flow

Nucs made this early in the season can outgrow the confines of the box very quickly. To avoid swarming, take care not to include too much brood in your nuc at this time of year.

To create a May 20 nuc, place:

1. One frame of foundation in positions 1 and 5
2. One frame of honey with adhering bees in position 2
3. One frame of mixed brood (some capped brood and some open larvae) with adhering bees in position 3 (Figure 3)
4. One frame of drawn comb in position 4

Then:

5. Shake one frame of bees originating from an open brood frame from the donor hive into the nuc. Take care not to accidentally shake in the queen.
6. Introduce a caged queen. Instructions below.

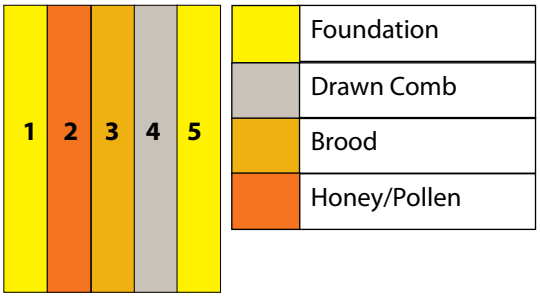


Figure 3. A frame of capped brood with adhering bees
Photo: Ramesh Sagili

June 20: Just before the peak of the primary nectar flow

Nucs made at this time of the year should have plenty of resources, as there is relatively less time for the colony to gain strength before winter. Nucs made in June must be made stronger than those made in May.

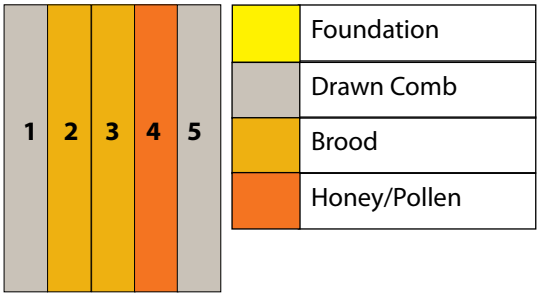
To create a June 20 nuc, place:

1. Two frames of drawn comb in positions 1 and 5
2. Two frames of mixed brood, with adhering nurse bees, in positions 2 and 3
3. One frame of honey with adhering bees in position 4

Then:

4. Shake one frame of bees from an open brood frame from the donor hive into the nuc. Take care not to get the queen.

5. Introduce a caged queen. Instructions below.



July 20: Post nectar flow

For successful overwintering, a nuc made after the nectar flow should be strong and contain enough food reserves.

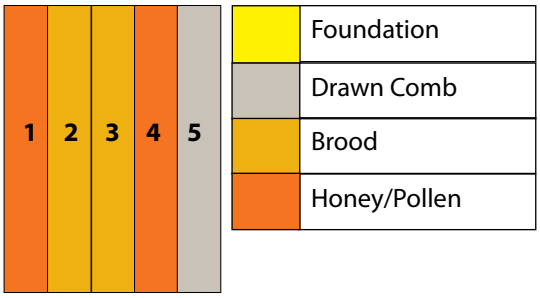
Note: In cooler, elevated regions of the Pacific Northwest (e.g., east of the Cascade Mountains), the latest date for producing a nuc for overwintering is approximately July 4. Use the same formula below for a July 4 nuc in these regions.

To create a July 20 nuc, place:

1. Two frames of honey with adhering bees in positions 1 and 4
2. Two frames of mixed brood with adhering bees in positions 2 and 3
3. One frame of drawn comb in position 5

Then:

4. Introduce a caged queen. Instructions below.



Introducing Queens

Although skillful beekeepers can use nucleus colonies to raise queens, nucs intended for overwintering will be more successful if they are provided with a queen. If the nuc is forced to raise a new queen from the provided open brood, 6 to 7 weeks will elapse before progeny of the new queen begins emerging. This can leave the nuc in a compromised state, with inadequate resources to survive the winter. For best results, purchase or procure a fresh, mated queen from a reputable source (Figure 4).

Figure 4. A young, healthy queen is critical for a honey bee colony's overwintering success.

Photo: Julie Miller

To introduce a mated queen in a new nucleus colony:

1. Remove any material, such as a cork, from the candy plug of the queen cage. If you are placing a candy plug yourself, be careful not to let the queen escape. Do not poke a hole in the candy plug. Many beekeepers report better queen acceptance when the candy plug is covered with a layer of paper-based masking tape, which will delay the release of the queen, giving the bees more time to accept her.
2. Place the queen cage between frames of open brood. It is important to ensure the screened side of the cage is facing the empty space between comb so that workers can access the

queen. If the screen is blocked, the queen may die before she is released. If there is only one frame of brood, as in the May 20 formula, place the queen on either side of that frame. If there are attendants in the cage, place it candy side up so that any dead attendants will not block the exit. If there are no attendants, it is best to place the cage candy side down.

3. Close the nucleus hive. Check the queen cage after one week to make sure the queen has been released. If the queen is still in the cage, cautiously release the queen. Keep the cage as close to the frames as possible when releasing the queen so that queen doesn't accidentally fly away. Do not disturb the bees for at least 7 days.

Caring for Nucleus Colonies

Once the nucleus hive is established and the queen is accepted, use the same care you would with a standard colony, with some modifications described below.

Controlling *Varroa* mites

Most medications and treatments are not dosed for nucleus-sized colonies, and may do serious harm if they are used incorrectly. The doses for the following miticides may be adjusted as indicated for use in nucleus colonies.

- HopGuard II: One strip per 5-frame colony
- Apivar: One strip per 5-frame colony
- Apiguard: 25 grams (purchase tub of Apiguard with delivery pads as a vehicle for the 25-gram dose)
- Oxalic acid: 5 milliliter oxalic acid solution (see label instructions) between each frame of bees. Oxalic acid treatment may not yet be legal in all states. Check with your state department of agriculture or beekeeper's association regarding registration of oxalic acid in your area.

As with all medications, it is critical to follow the label instructions closely.

Winter preparations

It is often necessary to feed nucs before winter. There are two main objectives of this pre-winter feeding:

- Provisioning the colony with stores to last through winter. Each nuc should weigh about 45 pounds by the time feeding is stopped (Figure 5).
- Allowing the bees to "profile" the brood nest into a consolidated sphere, with honey stores overhead and to all sides. It is critical that the brood nest is situated as low as possible in the nucleus colony, with a ceiling of honey stores overhead. The brood nest will slowly move upward as winter progresses. The position of the brood nest is as important as providing adequate food stores.

Figure 5. Each nuc should weigh about 45 pounds by the time feeding is stopped.

Photo: Harry Vanderpool

To accomplish these objectives, begin feeding with heavy syrup made with 2 parts sucrose (sugar) to 1 part water in August, or as soon as possible after the nectar flow ends. Early feeding gives the colony time to process the syrup, profile the brood nest, and avoid additional moisture in the colony when the weather may be cold and wet.

Figure 6. Feeding sugar syrup using jars with perforated lids

Photo: Harry Vanderpool

Nucs may be fed through the feeder tops using jars with perforated lids (Figure 6). Shelter the feeding jars from sunlight while they are on the nucs. Syrup will expand as it warms, and could flow out of the jar and onto the cluster of bees. If inclement weather arrives when quart feeders are in place, shelter nucs to prevent water from running down into the hive through the feeder openings.

Nucleus colonies are smaller than standard colonies, whose bee cluster generates adequate heat, and need insulation from the cold temperatures. Insulation should not block bee movement, and should be easy to install, remove, and reuse. For best results, use a combination of rigid foam insulation board and roofing felt to protect the colony from rain.

1. Cut three pieces of insulation board a few inches longer than the length of the nuc box. Cut an additional piece to fit at the back on the nuc.
2. Using duct tape, secure the boards around the top, sides, and back of the nuc. The board should extend beyond the front of the box (Figure 7).
3. Cut a sheet of roofing felt to cover the front, sides, and back. Use strapping or duct tape to secure the felt (Figure 8, page 6).

These components can be easily removed from the nuc in the spring, and stored for future years.

Figure 7. A nuc covered with foam insulation and ready for roofing felt

Photo: Harry Vanderpool

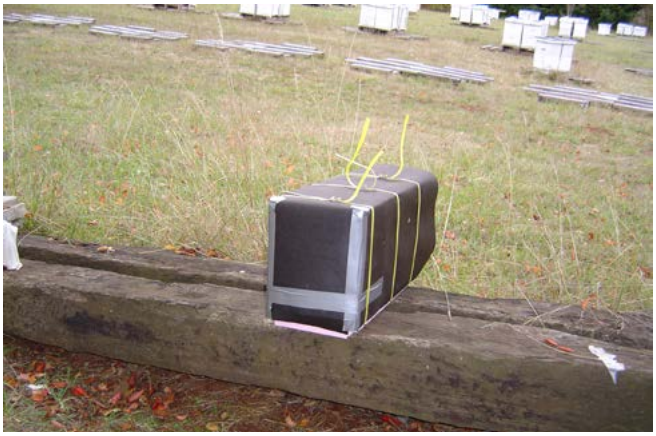


Figure 8. An insulated nucleus colony covered in roofing felt and ready for winter

Photo: Harry Vanderpool

Swarm Control

Because nucs are much smaller than standard colonies, they swarm with greater frequency. The bee population will reach its lowest point about 5 to 6 weeks after the swarm date. This extended period of decline can leave a nucleus colony with too few bees to survive the winter. Therefore, swarm control is an important component of caring for a nucleus colony.

Options for relieving congestion of the nucleus hive include:

1. Removing frames of brood from robust nucs to give to weaker hives
2. "Supering" nucs during the nectar flow by placing a nuc-sized box and frames above the nuc hive

Spring Management

Each year is different in terms of weather. In years with warm, mild winters, nucs can consume above-average amounts of stores. Beekeepers must be vigilant in assessment of colony weight as spring approaches. Depending upon the intended utilization time of the nucleus hive, emergency supplemental feeding may be warranted. Beekeepers should regularly heft nucs to become accustomed to the proper heft weight in relation to calendar date.

References

Steinhauer, N., K. Rennich, M.E. Wilson, D.M. Caron, E.J. Lengerich, J.S. Pettis, R. Rose, J.A. Skinner, D.R. Tarpy, J.T. Wilkes, J.T., D. vanEnglelsdorp. 2014. A national survey of managed honey bee 2012-2013 annual colony losses in the USA: results from the Bee Informed Partnership. *Journal of Apicultural Research* 53 (1): 1-18.

Use pesticides safely!

- Wear protective clothing and safety devices as recommended on the label. Bathe or shower after each use.
- Read the pesticide label—even if you've used the pesticide before. Follow closely the instructions on the label (and any other directions you have).
- Be cautious when you apply pesticides. Know your legal responsibility as a pesticide applicator. You may be liable for injury or damage resulting from pesticide use.

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