

Colony Strength Evaluation

Shannon Mueller, Ph.D.
Agronomy Farm Advisor
UC Cooperative Extension, Fresno County

Colony Strength Evaluation

Pollination success is dependent upon a number of factors, but in terms of the pollinator, it is a function of both the **number of colonies** and the **average strength** of the individual colonies.

- Colony strength can vary with time of the year and management by the beekeeper.

Colony Strength Evaluation

- Conducted at the request of the grower or the beekeeper.
 - The person requesting the certification typically pays for the inspection.
- Make every attempt to notify the beekeeper of the inspection and he or she can observe the process or assist in handling the hives if desired.

Colony Strength Evaluation

- Any or all of the following factors might be considered in colony strength evaluation
 - Presence and quality of the queen
 - Size of the worker population (frames of bees)
 - Amount of brood (i.e. alfalfa seed pollination)



Colony Strength Evaluation

- The contract states the standards for colony strength to which the grower and the beekeeper have agreed.
 - *average* and *minimum* strength requirements
 - 8 frame average and a 4 frame minimum
 - *outside temperature at the field site* for inspection.
 - Temperature of 60°F or higher or when a majority of hives in the apiary have bee flight
 - inspection should take place *within specified # of days after placement*
 - Upon 36 hours notice, the beekeeper agrees to open and demonstrate the strength of 10% of the colonies randomly as selected by the grower. Inspection is to be made after the hives have been placed in the fields for no less than 14 days and there has been at least 4 consecutive days of 60 degree weather temperature, no rain and no winds over 10 mph. The inspection will take place after 1 PM and under the following conditions.....
- Inspector is a neutral third party and gives an impartial evaluation of what is observed.

Colony Strength Evaluation

Visual inspection of the colony is required. All hives must be accessible. Hives can't be double stacked, banded, or presented in such a fashion as to prevent inspection.



Colony Strength Evaluation

- Generally the inspection includes only a *representative sample* of the hives in the apiary
 - Random or Systematic selection



Supplies to Bring to Inspection

- Required
 - Bee Suit, Pant Clips, Veil, and Gloves
 - Hive Tools
 - Smoker, Fuel, & Matches
 - Clipboard with data sheet listing hives to be inspected
 - Thermometer
- Recommended
 - Toothpicks/Matchsticks
 - Sample Jars/Bags and a Marker to label them
 - Lumber Marking Crayon
 - Camera



Presence and quality of the queen

- “Actively laying queen”
 - Presence of eggs will indicate queen activity within last 3 days.
 - Examine the brood. Look for a solid, good-sized brood pattern.
 - Be careful not to damage the queen during the inspection!



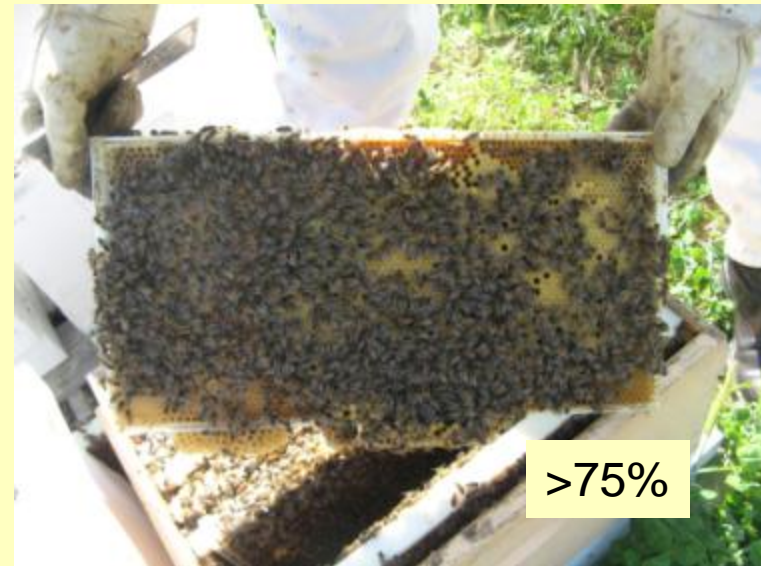
Size of the Worker Population

Definition of “Frame of Bees” should be *specified in the contract*.

- Two sides of standard Hoffman frame of comb (8” X 17”) or equivalent comb area at least 75% covered by bees at a density of 4 bees per square inch or more.
 - Area of frames with less than 75% coverage shall be combined and counted toward the standard of an active frame of bees.
 - Non-standard frames shall be converted to the equivalent of a standard frame.

Size of the Worker Population

- Frames of Bees



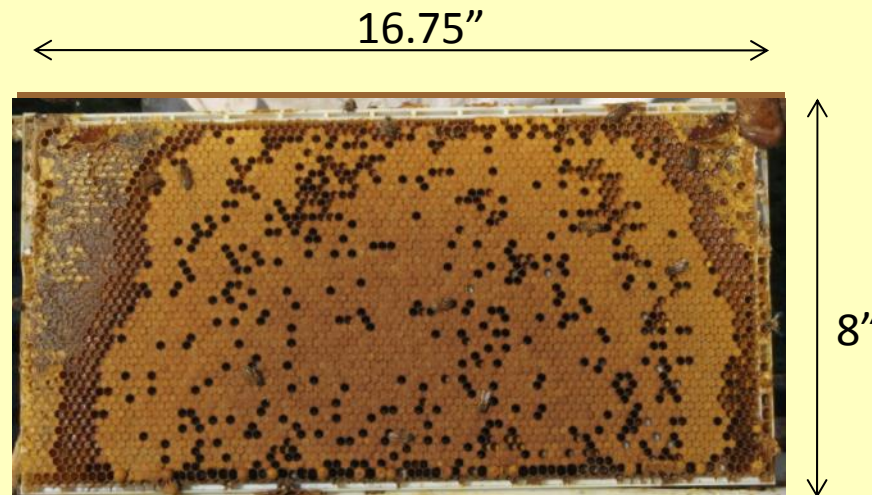
Amount of Brood

- Evaluate each side of the frame
 - Total area containing healthy brood *in any stage of development*, including open cells and capped brood.
- Record the in² or % coverage for each side of the frame



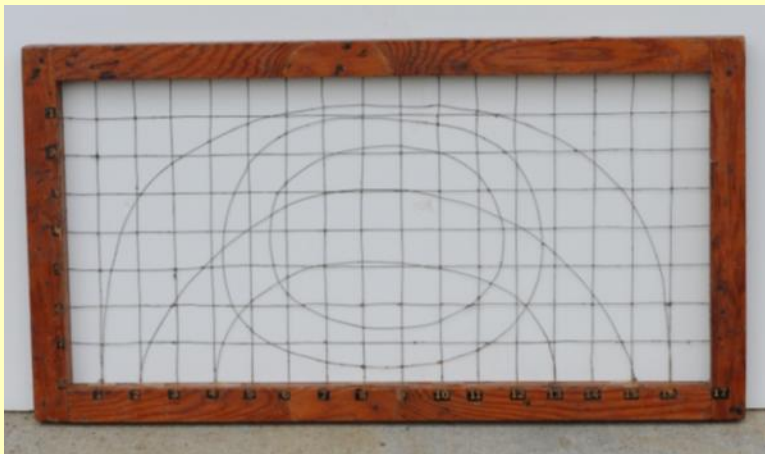
Colony Strength Evaluation

- Amount of brood
 - Frame with comb:
 - 8 inches x 16.75 inches = **134 in²** (on each side)



Colony Strength Evaluation

- Reference templates are highly recommended
 - It is very difficult to estimate square inches without a template.



Colony Strength Evaluation

- Reference something with known area
 - Examples
 - 3 X 5 card = 15 in² (11%)
 - Sheet of notebook paper (8.5 x 11) = 93.5 in² (70%)



Colony Strength Evaluation Methods



- Frame Inspection
 - Judging individual frames
- Cluster Count Method
 - Viewing the cluster from above and below without removing frames from the hive
 - Based on frames of bees only, not brood.

Frame Inspection

- Takes more time
- Requires experience in handling the hive
- Causes excessive colony disturbance, especially during cold, early spring days
- May damage or kill the queen as a result of the extra handling and prolonged exposure



Frame Inspection

- Single story hive
 - Smoke the entrance and under the lid
 - Remove lid
- Two-story hive
 - Smoke the entrance
 - Separate the two stories using your hive tool

Frame Inspection



- During spring inspections, in a two-story hive, the top box is examined first followed by evaluation of the bottom box.
 - The bottom box may be $\frac{1}{2}$ to totally empty if the bees have worked their way up into food stores above the brood.

Frame Inspection



Mid-season, the brood chamber is likely to fill two boxes and some beekeepers prefer to work from the bottom up if there are a lot of bees.

- Set the top box aside, evaluate the bottom box, then return the top box to position and evaluate it.



Frame Inspection

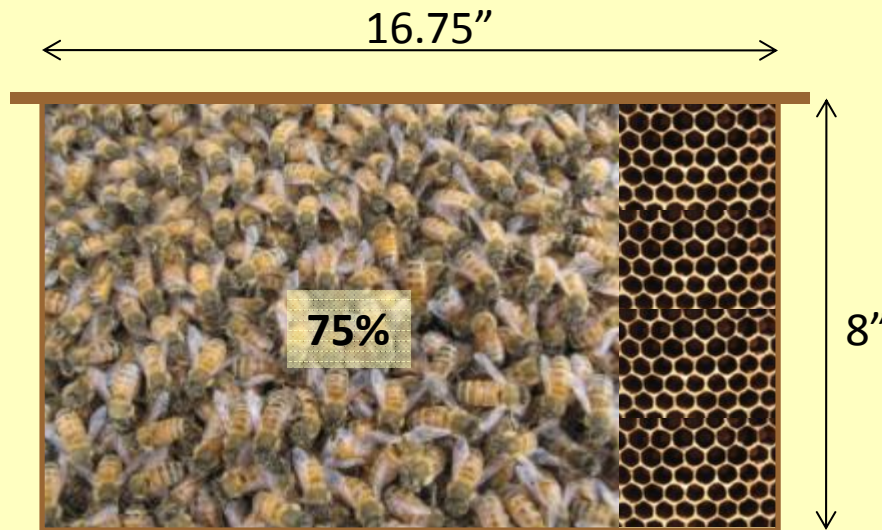


Assess both sides of each frame while holding it over the open hive.



Frame Inspection

- Frames of Bees
 - A frame of bees is defined as *75% covered on both sides* of a standard frame of comb.
 - Partial frames, add parts to make whole numbers.



*Whole comb,
including the frame,
densely covered by a
layer of bees
= 1000 bees per side*

Frame Inspection



Top story set aside



Remove an outside frame, check for the queen, and set it aside

Remove Frame 1, examine bees and brood, check for queen, place next to hive



Remove Frame 2, examine bees and brood, replace in hive in position of Frame 1



Remove Frame 3, examine bees and brood, replace in hive in position of Frame 2



Remove Frame 4, examine bees and brood, replace in hive in position of Frame 3



Remove Frame 5, examine bees and brood, replace in hive in position of Frame 4, etc.



Push everything back into its original position and replace the first frame.



Frame Inspection

- Replace top story and inspect it
- Replace the lid
- Make sure everything is squared up
- Move on to the next hive

Cluster Count Method



- Rapid
- Easier, moderate experience required once inspector develops a feel for the technique
- Not excessively disruptive to the colony
- May crush the queen if she is on the top or bottom bars when hives are repositioned

Colony Strength Evaluation using the Cluster Count Method



Identify the randomly selected
hive to be inspected.
Random or Systematic selection

Colony Strength Evaluation using the Cluster Count Method



Open the hive in the middle of the brood nest.
Tilt the upper box onto the edge or the cleat of the lower box.

Colony Strength Evaluation using the Cluster Count Method



Frames in top box
+
Frames in bottom box
=
Colony Strength

Colony Strength Evaluation using the Cluster Count Method

*Don't just look at bees on the top and bottom bars.
Look down, between the frames.*



Colony Strength Evaluation using the Cluster Count Method



RULE OF THUMB

Late winter/Early spring

Top – be generous

Bottom - be more conservative.

This is the bottom of the brood nest.

Cluster Count Method



View from top bars

View from bottom bars

Cluster Count Method



Strong colonies – 15 to 18 frame hives.

When a colony is strong, sometimes it is easier to count the *missing* frames and subtract from the total.

Number of frames may vary *within & between* hives

7-10 frames per box



10 frames in top and bottom



9 frames in top and 10 in bottom



7 frames + feeder in top
9 frames in bottom

Colony Strength Evaluation

- All deadout colonies included in the official random sample are recorded as part of the official random inspection.
 - *If the hive is in the orchard, it is part of the population. If the beekeeper doesn't want it to be counted, it should be taken OUT of the apiary.*
- Colonies found with symptoms of AFB must be marked and the beekeeper or regulatory agency will make sure they are abated as required by law.



Colony Strength Evaluation

- Accounting for bees in the field
 - When temperatures are warm, bees are flying and may not be accounted for in the strength evaluation, but they can represent a substantial portion of the colony population and could be accounted for if desired.
 - Rules of thumb:
 - 4 frame hive – 25% of bees in field = 5 frame hive
 - 8 frame hive – 30-33% of bees in field = 10 or 11 frame hive

Accounting for Bees in the Field

- Count the number of bees returning to the colony in a 60 second period.
 - On a warm, sunny day, a dozen bees should be seen entering and exiting the hive at any one time.
 - Use the lid to block the entrance and see how many bees back up over a given amount of time.

Accounting for Bees in the Field

TB = total number of bees in the field

t = average round trip flight time for a forager (assume 30 minutes)

n = number of bees returning during a 60 second period (counted at hive entrance)

Example:

$$TB = t \times n$$

$$TB = 30 \text{ minutes} \times (150 \text{ bees/minute}) = 4500 \text{ bees}$$

Convert to frames of bees:

Assume 2000 bees per frame (both sides)

$$4500 \text{ bees} * (1 \text{ frame}/2000 \text{ bees})$$

$$4500 \text{ bees} * 0.0005 \text{ frame/bee}$$

2.25 frames of bees

Add this to the estimate of the number of frames of bees from the hive inspection. Note it on the evaluation form using the following equation:

$$\text{Foraging Bee Adjustment} = \text{__bees/minute} * 30 \text{ minutes} * (0.0005 \text{ frame/bee}) = \text{__ full depth frames of bees}$$

Colony Strength Evaluation

After inspecting each hive, put it back the way you found it and move on to the next hive to be inspected. When finished, complete your report and provide a copy to the grower and to the beekeeper.



Colony Strength Evaluation

Colony strength evaluations help almond producers make sure they are getting what they pay for in terms of numbers of colonies at a strength specified in the pollination contract.

The inspections also help ensure that beekeepers are appropriately compensated for their additional expense in providing quality hives for spring pollination.

Understanding the evaluation process helps make contract expectations clear.