

APPENDIX

Thirty Trees Sampling Method for CBB Monitoring

Based on a Presentation by Luis F. Aristizábal (University of Florida)
Revised: January 2014 by CBB Summit Committee

It is not enough to know that your coffee trees are infested with the cherry berry borer. It is also important to understand what the beetle is doing on your farm. In addition, it is important to understand that cherry infestation is not equal to bean damage. This simple sampling method will show you cherry infestation and bean damage levels, but more importantly, it will show whether the beetle is vulnerable to being killed by spray or not. Sampling will also help you determine the effectiveness of your spray program, may reveal hot spots, and will show you the best management strategies for CBB control on your farm.

Begin monitoring and sampling about 30 days after your initial flowering or as soon as there is an increase in CBB activity, as indicated by trap catch or visual observations. Continue monitoring through the end of the harvest, sampling green berries only. Sample your farm every 2 weeks at the beginning of the season to catch early-season infestations and then monthly thereafter. Sample at least 30 trees per 2.5-acre plot to accord with the Cenicafé method of sampling. For smaller plots, sample a minimum of 12 trees per acre to determine infestation level. A larger tree sampling population may provide a greater representation of the farm.

Individual farmers may need to adapt these protocols based on their particular situation and needs. For example, if your farm is situated on a relatively even terrain or microclimate and your trees have similar age, management practices, etc., a single sample size of 30 trees might be sufficient for a 3-acre plot. Conversely, you may need to subdivide your farm into smaller plots to address different varieties, tree ages, topography areas, areas with shade vs. sun, etc.

Materials

- Farm map
- Knife
- Clipboard
- Worksheet
- Pencil/pen
- Permanent marker
- Container with lid or resealable Ziploc bag
- Flagging tape or ribbon
- Hand lens, magnifying glass, reading glasses, or other vision aids
- Counter or tally counter

Step 1: Monitoring the CBB Infestation

1. Begin monitoring and sampling about 30 days after your initial flowering.
2. Select and draw a map of the coffee plot* to be sampled.

*Plot can be determined by these factors:

- Location, topography, physical features such as roads or gullies
- Orchard age or pruning stage
- Variety
- Kīpuka or microclimate
- Management practices (e.g., mechanization, organic vs. non-organic, pruning, availability of irrigation)

3. Mark a zigzag pattern on the map to follow as you sample.
 - a. At least 12 trees per acre, or
 - b. 30 trees per 2.5-acre plot.
4. Begin sampling at tree #1 close to a corner of the coffee plot, but avoid sampling trees directly on the border.
5. Randomly select a lateral branch in the middle of the tree with at least 45 berries (more is better).
6. Record the total number of green berries on the branch, and
7. Record the number of green berries with visible white *Beauveria* fungus on the branch, and
8. Record the number of green berries infested by CBB (berries with a hole) on the branch.
9. Pick all CBB-infested green berries (including those showing fungus) from the branch and place them in the container or bag.
10. Flag any trees with high numbers of CBB.
11. Move to tree #2 and return to steps 5–10.
12. Repeat these steps until all samples are collected.

Now, take the information collected and make calculations to obtain the percentage of infestation by CBB:

$$\% \text{ infestation} = \frac{\text{Total \# of infested berries}}{\text{Total \# of green berries}} \times 100$$

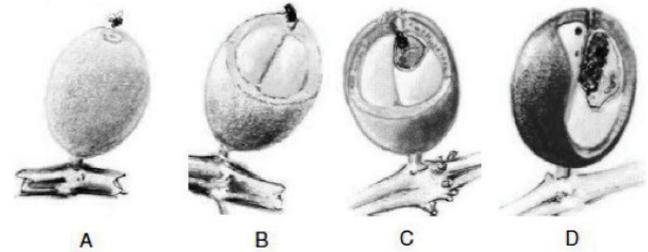
Example: For the 30 coffee branches sampled we have the following information:

Total # of infested berries = 40

Total # of green berries = 1,500

% infestation = $40 \div 1,500 \times 100 = 2.66\%$

Step 2: Positions of CBB in Berries Used to Determine Whether to Spray



Randomly select 100 infested green berries from those collected in your container. Carefully cut each berry and determine CBB position (AB or CD). Be careful not to kill the beetle while opening the berry, as determining whether the beetle is alive or dead is very important. Record the information on the worksheet provided.

In AB position, the CBB is entering or boring into the fruit, but the endosperm (coffee seed) has not been affected. You should be able to see the back part of the CBB body. In this position the CBB can be killed by natural enemies, weather, or by application of *Beauveria bassiana* or chemical insecticides. A high percentage of CBB alive in the AB position means they are vulnerable and may be controlled by applications of *B. bassiana*, pesticides or repellants. Spray as soon as possible. A high percentage of dead in the AB position means your spray is effective.

In CD position (inside the endosperm or coffee seed), CBB are relatively safe. The female and its progeny (larvae) have already damaged the bean. Neither *B. bassiana* nor chemical insecticides can effectively control CBB in this position. In the CD position, CBB may only be controlled by manual collection of ripe and unripe berries. A high percentage of CBB in the CD position means that your spray program was late or ineffective. Consider employing sanitation techniques to physically remove infested berries from the field. Review your spray techniques and program and alter for greater effectiveness.

Step 3: Decision-Making and Timing of Spray

The timing of *Beauveria* sprays may vary greatly from farm to farm. It is better to contain CBB populations early in the season than fight a larger infestation later.

In Colombia, the decision to spray is made when 5% of sampled green berries are infested in the AB position. However, at the value of the Kona crop, this infestation loss far exceeds the cost of spraying. It is more likely

that a 2% infestation in the AB position should trigger a decision to spray.

DRAFT

Thirty Trees Sampling Worksheet: Percent Infestation by CBB

Date: _____ Farm: _____

Plot # or ID: _____ Evaluator: _____

Branch	# of Green Berries	# of Infested Berries	# of Berries w/ <i>B. bassiana</i>
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			
17			
18			
19			
20			
21			
22			
23			
24			
25			
26			
27			
28			
29			
30			
Total			

% infestation =
$$\frac{\text{Total \# of infested berries}}{\text{Total \# of green berries}} \times 100 = \boxed{} \%$$

Positions of CBB in Berries Used to Determine When to Spray

Total # of Infested Berries =
Total # of Green Berries =

Tally of CBB
from infested
berries:

AB Alive =

CD =

AB Dead =

Absent =

% AB infestation =

$$\frac{\text{AB Alive} \times \text{Total \# of Infested Berries}}{\text{Total \# of Dissected Berries} \times \text{Total \# of Green Berries}} \times 100 = \boxed{} \%$$

Percent Bean Damage

% CD infestation =

$$\frac{\text{CD Alive} \times \text{Total \# of Infested Berries}}{\text{Total \# of Dissected Berries} \times \text{Total \# of Green Berries}} \times 100 = \boxed{} \%$$

Observations: