



How are we doing in the war with CBB? Comparing CBB surveys 2016 and 2015)

H.C. Bittenbender <hbitt@hawaii.edu>, Gwen Hicks <Gwendolyn.m.hicks@hawaii.gov>, A.M. Kawabata <andreak@hawaii.edu>, R.T. Curtiss <Robert.T.Curtiss@hawaii.gov>, and S.T. Nakamoto <snakamo@hawaii.edu>

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HDOA
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Highlights of 2016 Survey.

This year the survey was sent and data collected by Gwen Hicks and Rob Curtiss of the Hawaii Department of Agriculture (HDOA). This report covers questions **Q22 -67** below, that were asked in previous years. This 2016 survey covers the 2015-16 harvest and the 2016-17 growing season, as well as CBB control tactics used for the 2016-17 harvest season. 80 farms responded, an increase of 20 farms from the previous survey.

Crop loss due to CBB

Determining loss due to CBB in Kona is challenging. There are several ways to estimate CBB damage such as used by the Thirty Trees Method in the field, examining cherry or wet parchment at the mill, etc. The Marketable Green Bean Recovery Ratio (MGBRR) is a sensitive measure of CBB damage, but MGBRR does not measure only CBB damage. MGBRR will detect green bean loss due to discarded floating cherry and parchment- anything that reduces the green bean weight. MGBRR is adjusted to 0% CBB loss by using a historic MGBRR (5.49) prior to CBB developed by Greenwell Farms.

In 2016, 14 Kona growers reported their MGBRR was 6.9 (equivalent to 20% green bean loss) (**Q32**). MGBRR was calculated for 5 other farms and added to the 14 for 19 farms having 7.8 average MGBRR or 32% green bean loss. 40 farms that sell cherry said buyers determined 12% CBB-damaged cherry (**Q33**). Half the cherry buyers said the cherry they purchased had a 7.0 MGBRR (22% damage) (**Q66**). While there were more MGBRR values reported for the 2015-16 season compared to previous years, the damage does not appear to have decreased. Bean damage remained the same as reported last year for the 2014-15 harvest. However, farmers feel more optimistic about CBB's impact on the 2016-17 crop compared to the 2015-16 crop. 61% felt CBB damage was decreasing, 27% felt it was the same as 2015-16, and only 12% said CBB damage was increasing on their farm. At the same time in the 2015-16 season, 31% farms thought damages were increasing.

Sanitation.

Field sanitation when combined with other management techniques, is probably the most effective strategy for reducing CBB damaged bean in the current crop and further infestation in the following crop. Strip picking any immature berries, and ripe, over-ripe and raisin cherry at the end of the harvest season, reduces CBB infestation early in the following coffee season. 81% of farms strip picked 90 to 100% of trees at the end of the 2015-16 (**Q35**), an increase from 71% in 2014-15. These farms generally felt there was less damage early in the 2016-17 season. Farms that do less than 90% strip picking and farms that were not strip picked observed increased infestation and damage early in 2016-17 season. Most farms, 51%, strip pick in December and January (51%) (**Q36**). 85% of farms plan to strip pick 90 to 100% of their trees at the end of the 2016-17 season (**Q38**).

Leaving few ripe, over-ripe and raisin cherries on trees after each harvest round is another way to reduce CBB. Nearly 50% of farms say they left 5 or less ripe, overripe and dried cherries per tree after each picking round in the 2015-16 crop (**Q37**). Most farms (70%) in Kona are annually pruned in the Kona-style. Stumping by block has been shown to reduce infestation in the first crop season after pruning within these stump-pruned blocks. 10% of Big Island growers reported stumping by blocks to improve CBB control, a 100% increase from 2015 (**Q28**).

Monitoring CBB infestation in cherries.

The 12 tree sampling method is most popular among growers and is a minimum requirement of the Synergistic Hawaii Agriculture Council's (SHAC) *Beauveria* subsidy program. 55% responding farms use the 12 trees method, followed by 50% that use observation during walk-throughs and harvest. Only 26% of farms use trapping and 22% use

the 30 tree sampling method - both are considered too laborious for the benefit received (Q39). 33% of farms begin monitoring for CBB one month after the first flowering (Q40) and 55% sample for CBB every 3-4 weeks (Q41). 50% of farms said sampling helps to schedule sprays (very well to pretty good), but 25% did not sample mainly because they spray on a regular schedule (Q42). Over 60% of farms report their sampling method helped to determine the effectiveness of their sprays, while 17% did not sample (Q43). In the 2017-18 season 56% of farms say they will use the 12 trees sampling method and 54% will use observation (Q44).

Spraying commercial preparations of the fungus *Beauveria bassiana*.

The use of commercial *Beauveria bassiana* products has increased. In the 2016-17 season, 95% of farms used *B. bassiana*; an increase over 2015 and 2013, when 85% and 80% used it, respectively (Q45). BotaniGard is preferred 10 to 1 over Mycotrol O (now discontinued). 91% said spraying Beauveria products was effective (Q53). 28% of farms report spraying for CBB in April; while nearly 50% begin spraying before April, including 7% that spray year round. More farms began spraying earlier in the 2015-16 season though this may be due to when flowering occurred (Q46).

This year the responses for spraying were similar to 2015-16. 50% of farms spray every four weeks, 72% between 2 and 4 weeks, and 7% spray according to sampling results. Farms that spray based on samplings results reported 10.4% cherry damage. Farms that spray every three weeks reported 11.4% cherry damage and 22% green bean damage. Farms that spray every four weeks reported 12.3% cherry damage and 35% green bean damage. Why is “ % cherry damage” lower than “ % green bean damage”? We don’t know yet. So-called cherry damage determination begins with sampling a bag of cherries and counting cherries showing CBB entry holes. Green damage reported here is based on the MGBRR, which is the weight of marketable green bean harvested in 2015-16 divided by the reported cherry weight harvested in 2015-16. As calculated the two methods used in this survey estimate CBB damage do not relate as expected. However note that as % cherry damage increased so did % green damage.

In the 2016-17 season farms increased the amount of *Beauveria* product used per application. 39% of farms spray 32 oz per acre and 25% spray 16 oz per acre. Reported cherry damage and MGBRR for these two rates of BotaniGard/ Mycotrol were 11% cherry damage and 6.9 MGBRR for 32 oz/acre and 15.5 % cherry damage and 10 MGBRR for 16 oz/ acre in the 2015-2016 season (Q49). Without the subsidy, 9% of farms would stop spraying, plus 70% would be spraying less than the recommended 32 oz per acre (Q51). This would result in increased CBB damage and only strict sanitation and frequent, complete harvests might prevent larger losses. Without the subsidy, 30% of farms would quit coffee or strongly consider it (Q52).

Spraying other insecticides to control CBB.

24 farms tried Pyganic, Pyronyl or Evergreen and rated them as somewhat effective. 12 farms found Surround WP or kaolin clay slightly less effective, and 10 found Admire Pro even less effective. One farm found Azatrol, a neem concentrate, to be effective. Garlic barrier and BAM were ineffective (Q54).

OMRI certified pyrethrin products like Evergreen Pyrethrum Concentrate® or Pyganic 5.0 EC products lack Pipernyl butoxide (PBO), an ‘activator’ found in many other pyrethrin-containing products like Pyronyl. PBO is a concern because Japan had not developed a residue tolerance to PBO in green coffee, this may be resolved by now.

Economic impacts.

Insecticide costs (BotaniGard or Mycotrol), followed closely by maintenance of the trees (sanitation focused harvest and end-of-season strip harvesting costs) and hired labor costs had the greatest increase due to CBB infestation. Kona farms responding said **8% had a loss in the 2015-16 crop, an improvement over the 30% who took a loss in the 2014-15 season.** 23% made less than \$1,000 in profit (Qs 55, 56, 59).

Are farmers leaving coffee due to CBB?

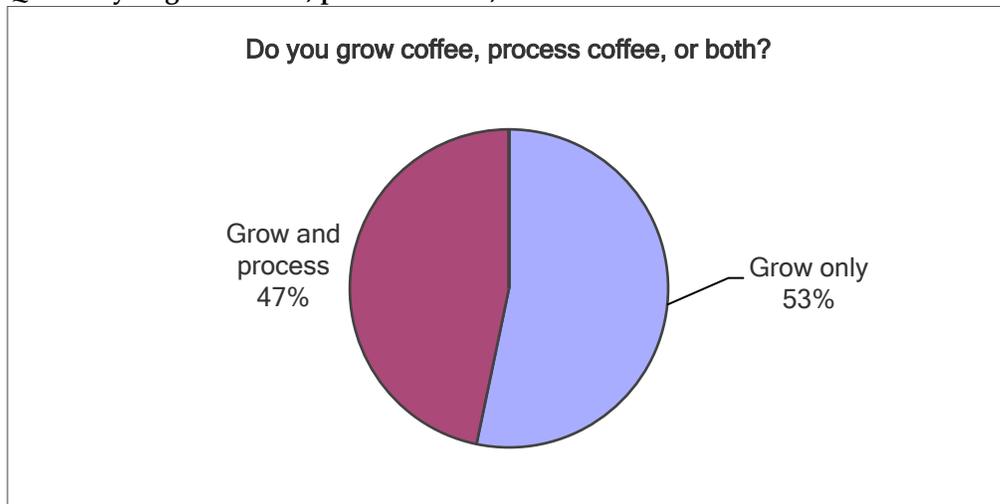
6% of responding farms said they will stop growing coffee, 82% are continuing in coffee and 12% are considering quitting. This is similar to 2015 (Q62). 51% of farmers knew 1-4 farmers leaving coffee due to CBB and 11% knew more than 5 farmers were quitting; only 38% said they didn't know anyone leaving. This is similar to last year as well (Q63).

Where do you get CBB information?

Talking with other growers (78%) is the most common source of information, followed by CTAHR web pages (68%) incl. hawaiicoffee.weebly, and CTAHR workshops (58%) (Q64).

Questions and responses, followed by comments.

Q22. Do you grow coffee, process coffee, or both?



80 farms responded - 44 grow only, 36 grow, buy cherry, and process.

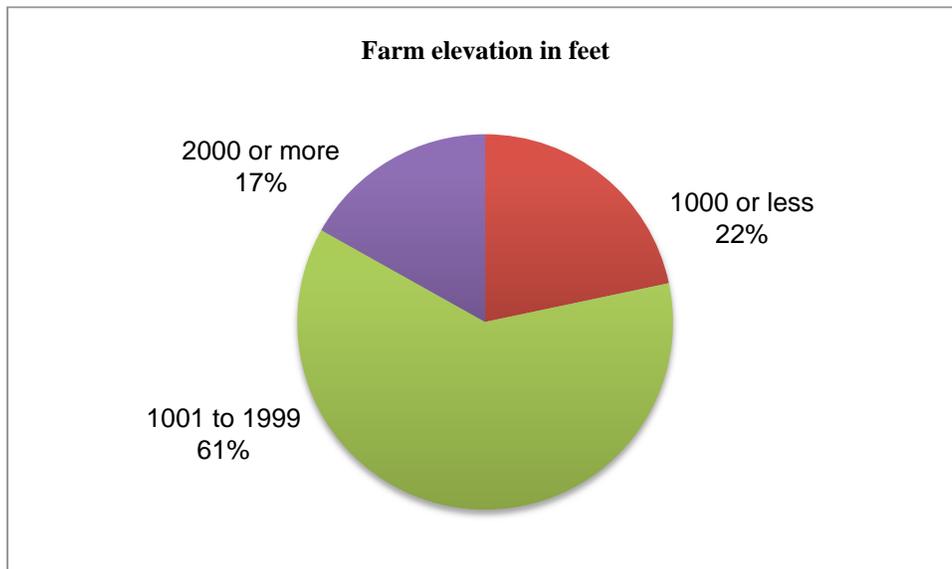
Q23. On which island are you farming coffee?

100% responses were from the Big Island.

Q24. If you grow coffee on the Big Island, in what district do you grow coffee?

90% from Kona, 6% from Kau, 1% each from Hamakua and Hilo, and 3% from Puna.

Q25. What is the elevation of your farm?



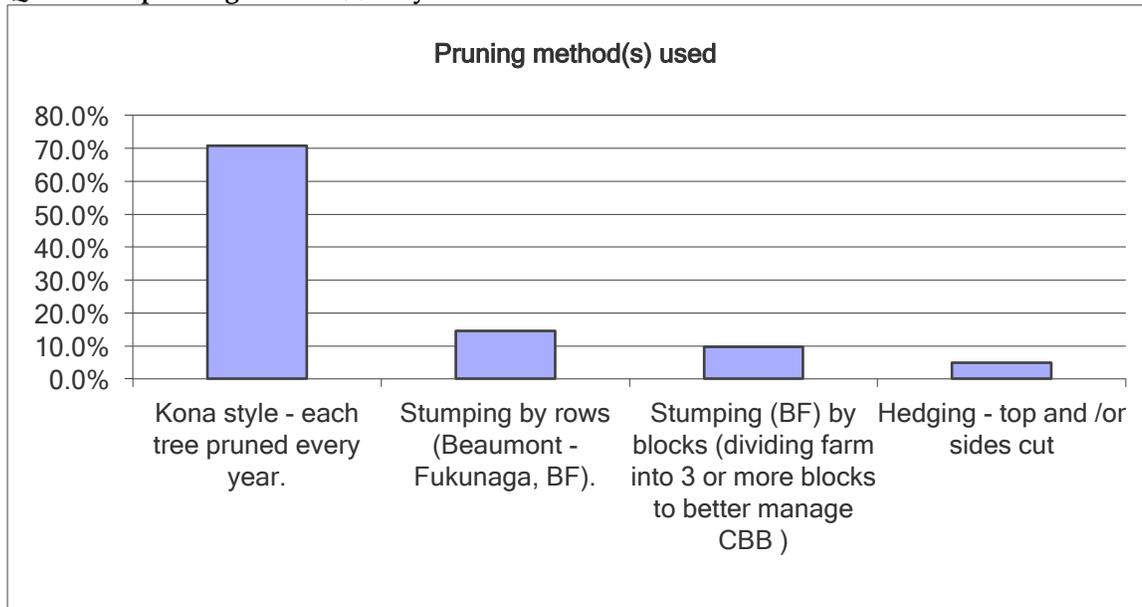
Q26. How big is your coffee farm?

Response represents 695 acres (410,000 trees) on the Big Island mostly in Kona, averaging 8.7 acres and 589 trees per acre. However the median size farm is 4 acres; 50% of farms are less and 50% are larger.

Q27. What is the normal tree spacing on your farm?

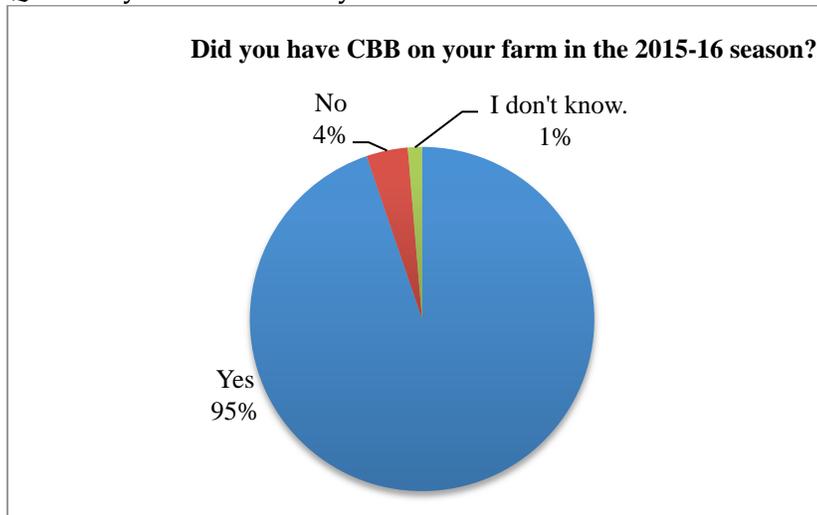
Average is 6.1 ft. between trees and 9 ft. between rows.

Q28. What pruning method(s) do you use?



Big Island growers reported 10% were using stumping by blocks which improves CBB control, this is double what was reported in 2015. Over two-thirds (70%) prune Kona style.

Q29. Did you have CBB on your farm in the 2015-16 season?



Q30. What was your total cherry yield in pounds for the 2015-16 season?

The average reported by 77 farms representing 695 acres was 28,304 lb cherry per farm or 3330 lb cherry /acre. Median farm yield was 3000 lb/acre, meaning 50% farms had less and 50% greater cherry yield.

Q31. What was your marketable green bean yield in pounds for the 2015-16 season?

The average of 19 farms was 4,110 lb marketable green bean.

Q32. Marketable Green Bean Recovery Ratio (MGBRR) is the weight of cherry harvested during the 2015-16 season divided by the weight of marketable green bean, what was yours?

14 Kona growers reported their MGBRR was 6.9 (20% green bean loss). MGBRR was calculated for 5 other farms and added to the 14 for 19 farms having 7.8 average MGBRR or 32% green bean loss. MGBRR before CBB arrived was 5.49.

Q33. If you sell only cherry but your buyer samples your cherry and tells you the percent CBB damage please list all the damage values given to you for the 2015-16 season. List damage starting with early to last harvest, example 10, 20, 30, 50....

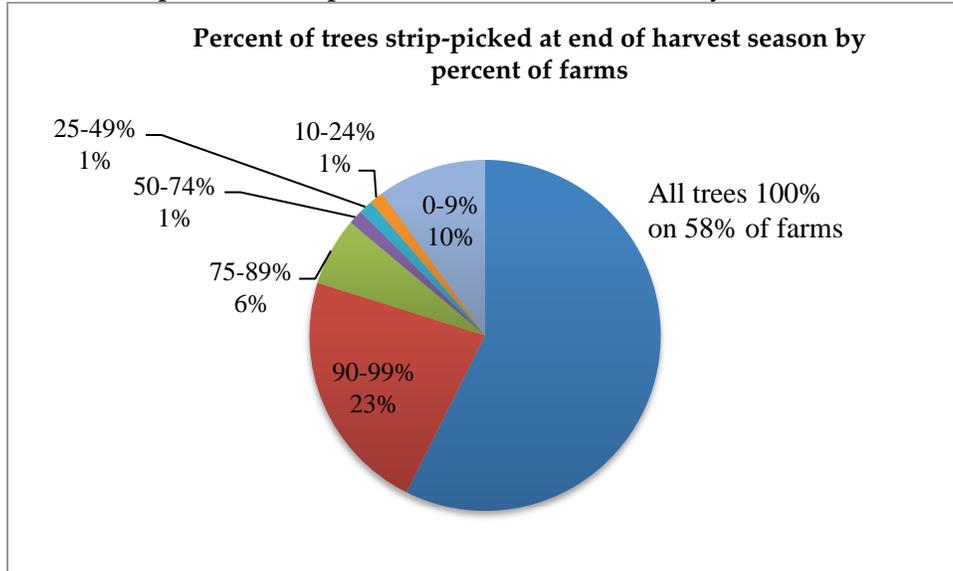
40 farms that sell cherry said their average CBB damaged cherry determined by the processor was 12%.

Q34. Compared to the beginning of the 2015-16 harvest season how does the CBB damage level on your farm look at the beginning of the 2016-17 season? Is CBB damage increasing, the same or decreasing?

23% of farms said CBB was increasing, 31% said CBB was the same (a similar response to 2014), and 46% said CBB was decreasing in 2015.

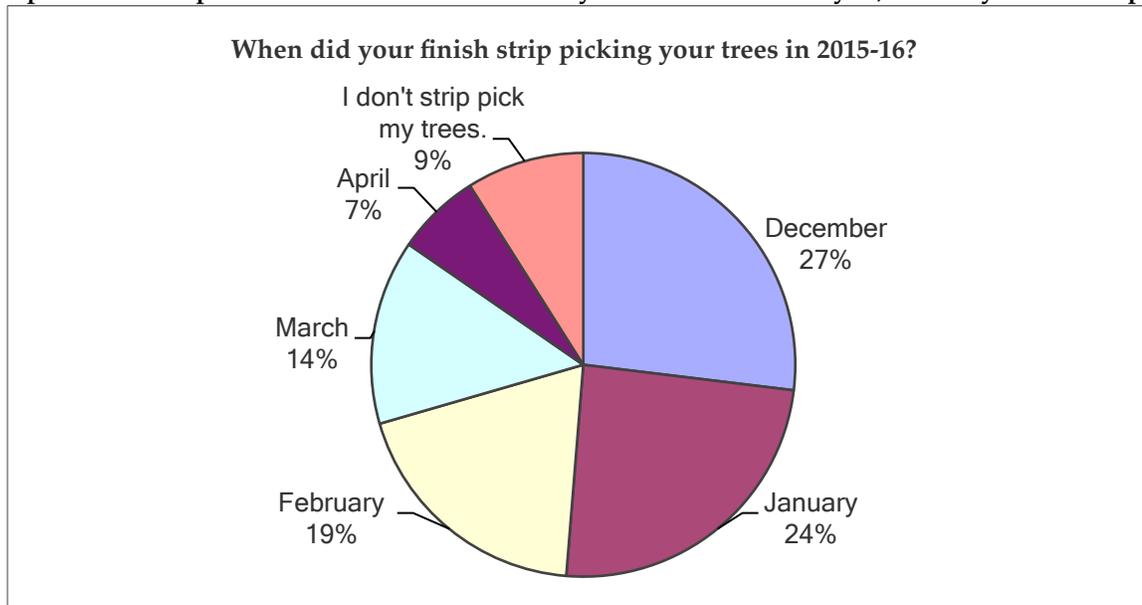
Farmers felt more optimistic about CBB impact on the 2016-17 crop compared to the 2015-16 crop, 61% felt CBB damage was decreasing, 27% felt it was the same as 2015-16 and only 12% said CBB was increasing on their farm.

Q35. After the 2015-16 harvest season was completed, what percent of your trees were strip picked; that is all immature, ripe and over-ripe cherries were removed from your trees and destroyed, even if you did not prune?



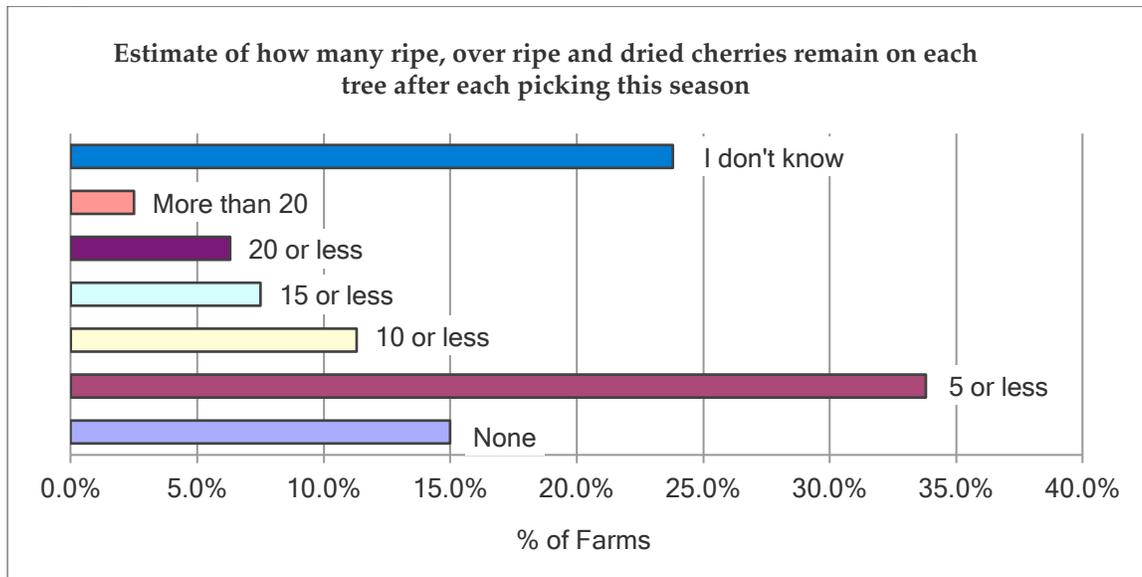
81% of farms strip picked 90% to 100% of trees at the end of the 2015-16, an increase from 71% in 2014-15. These farms generally felt there was less damage early in the 2016-17 season. Farms that strip pick less than 90% of trees observed increased damage early in 2016-17.

Q36 After the 2015-16 harvest season was completed, when did your finish strip picking your trees? All immature, ripe and over-ripe cherries were removed from your trees and destroyed, even if you did not prune.



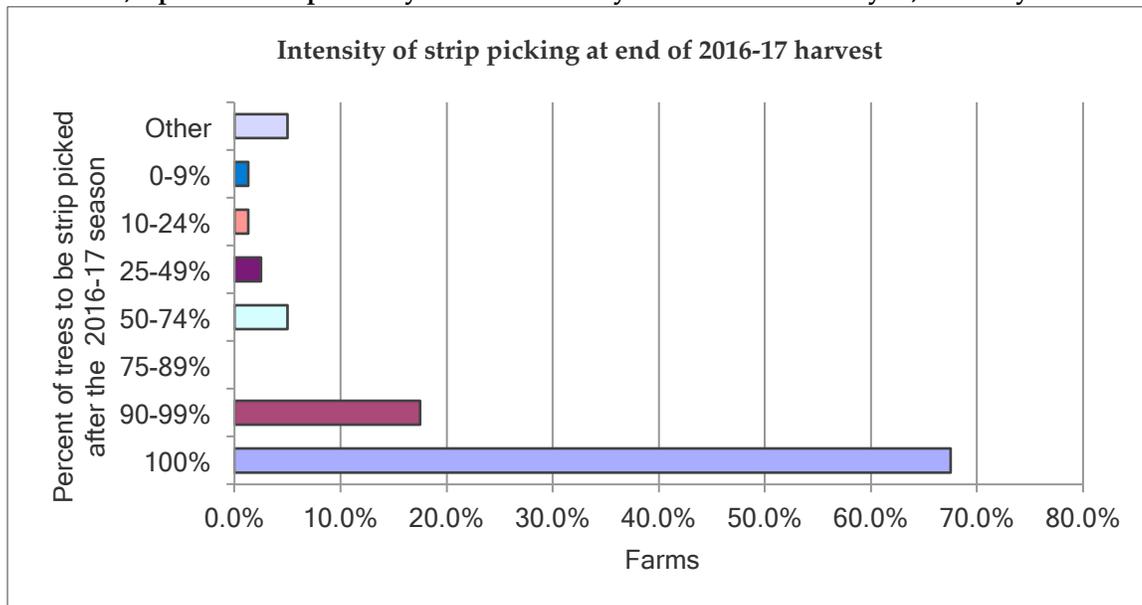
Most farms strip pick in December and January (51%). If the farm was not strip picked by then, farmers felt damage was increasing in 2016-17 season.

Q37. Can you estimate how many ripe, over ripe and dried cherries remain on each tree after each picking this season?



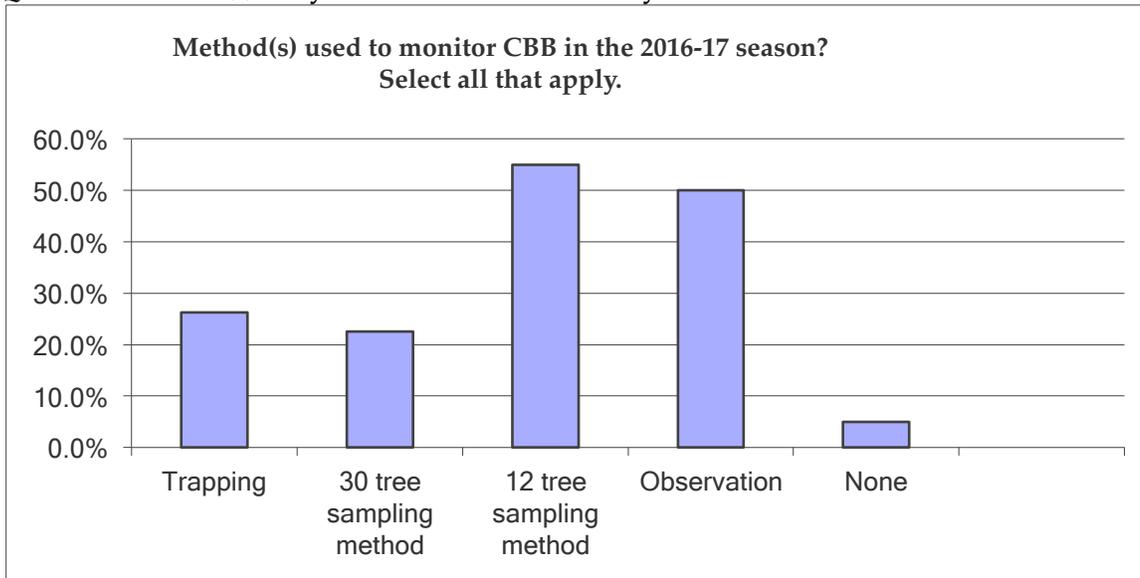
Nearly 50% of farms say they left 5 or less ripe, overripe and dried cherries on each tree after a picking round in the 2015-16 crop. CBB reproduce rapidly, so such cherries can infest the remaining crop that is not yet harvested.

Q38. After this 2016-17 harvest season is completed, what percent of your trees will you have strip picked - all immature, ripe or over-ripe cherry- removed from your trees and destroyed, even if you did not prune?



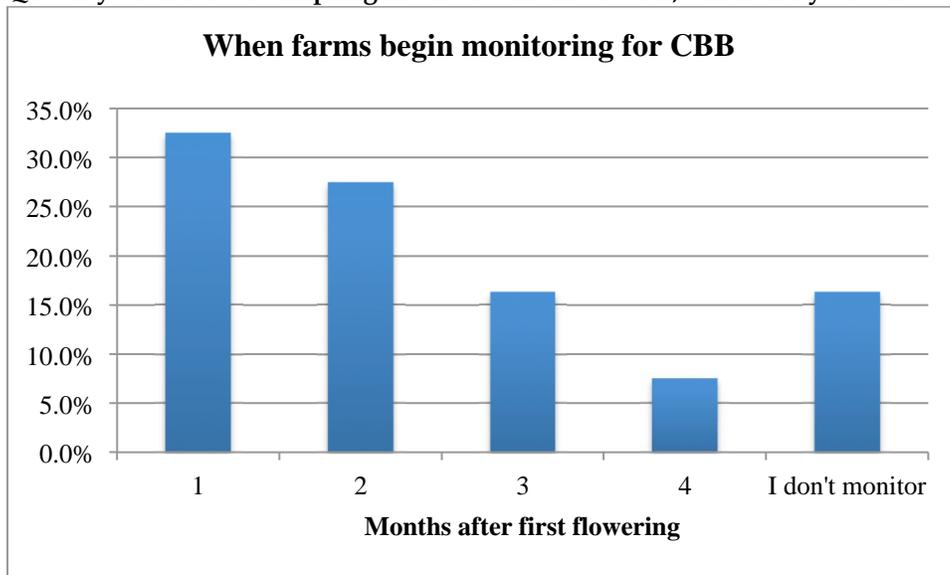
85% of farms plan to strip pick 90 to 100% trees at the end of the 2016-17 season. Strip picking at the end of the season and processing or destroying cherries is a sanitation practice known to reduce early season CBB infestation in the following harvest season.

Q39. What method(s) did you use to monitor CBB on your farm this 2016-17 season? Select all that apply.

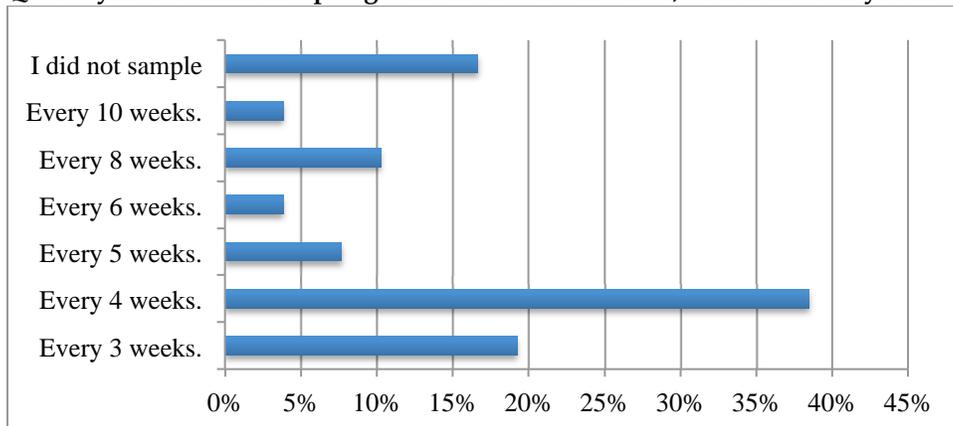


The 12 tree sampling method is most popular; 55% responding farms use it, followed by 50% that use observation during walk-throughs and harvest. Only 26% of farms use trapping and 22% use the 30 trees sampling method. The latter two are considered too laborious for the benefit that is received based on farmers comments on the survey.

Q40. If you did use a sampling method to monitor CBB, when did you start?

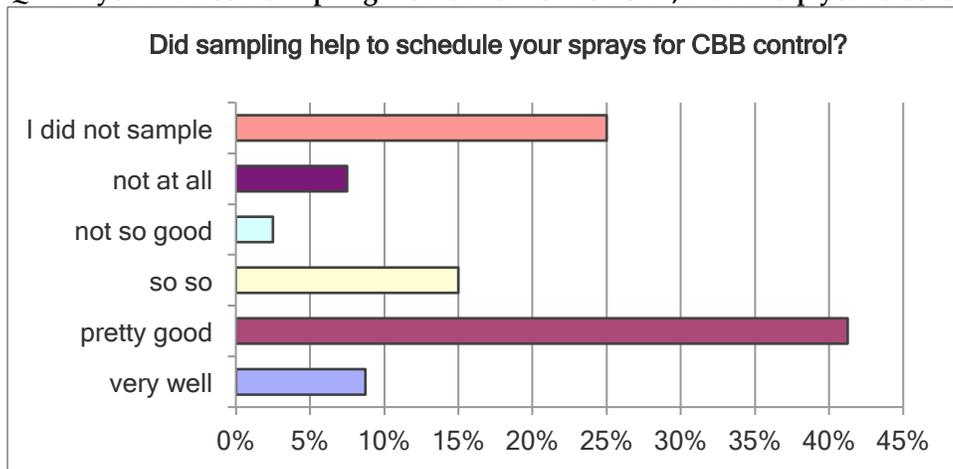


Q41. If you did use a sampling method to monitor CBB, how often did you sample?



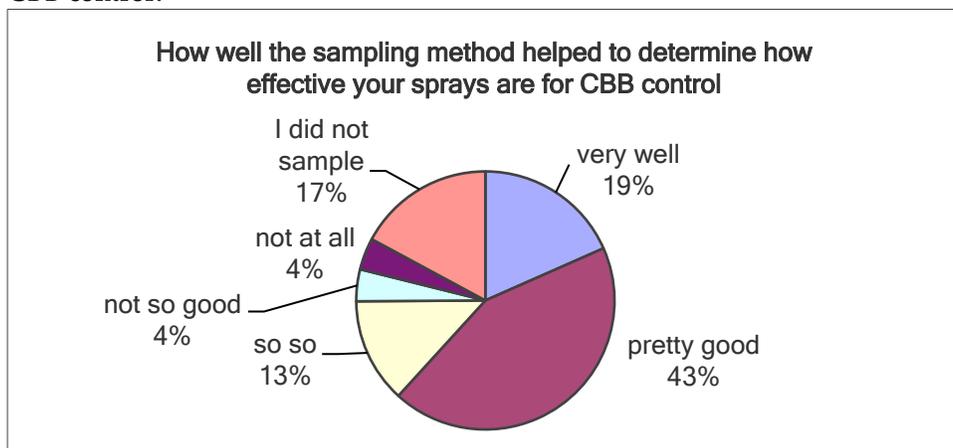
55% of farms sampled for CBB every 3-4 weeks.

Q42. If you did use a sampling method to monitor CBB, did it help you to schedule your sprays for CBB control?



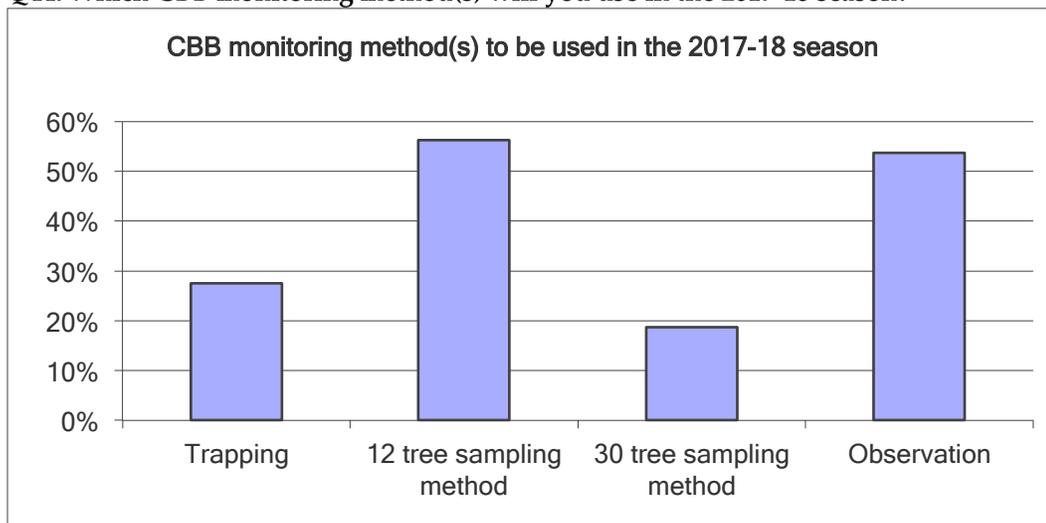
50% of farms said sampling helped schedule sprays (very well to pretty good), but 25% did not sample mainly because they spray on regular schedule.

Q43. How well did the sampling method to monitor CBB help you to determine how effective your sprays are for CBB control?



Over 60% of farms report their sampling method helped to determine the effectiveness of their sprays, while 17% did not sample.

Q44. Which CBB monitoring method(s) will you use in the 2017-18 season?

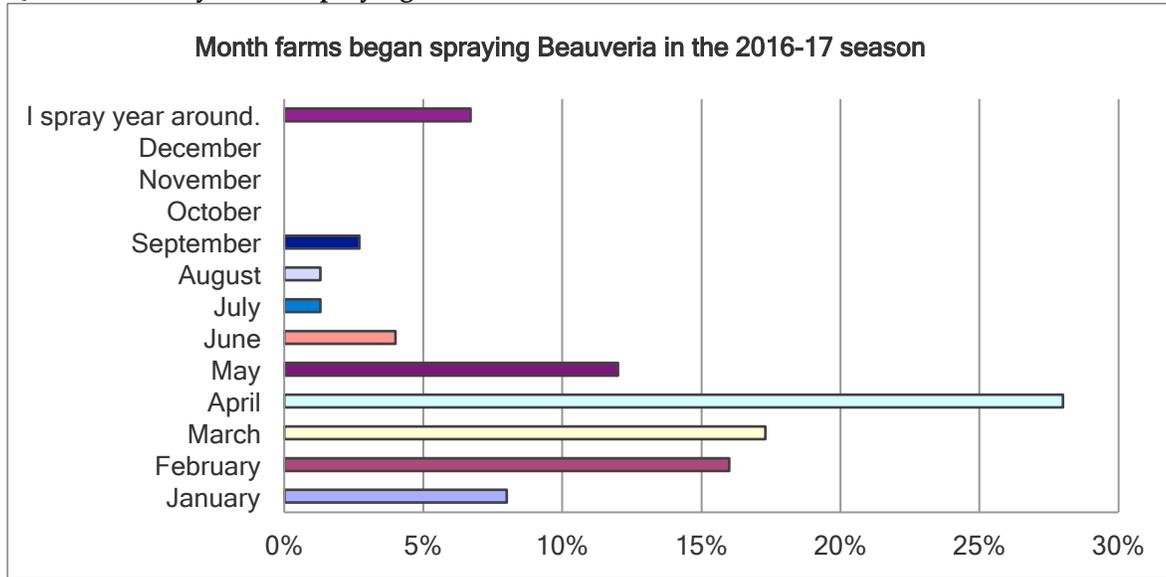


56% of farms indicate they will use the 12 trees sampling method and 54% will use observation. The decline in popularity of the '30 trees sampling method' and trapping represent additional costs without sufficient benefit.

Q45. Did you spray commercial insecticides that contain Beauveria bassiana?

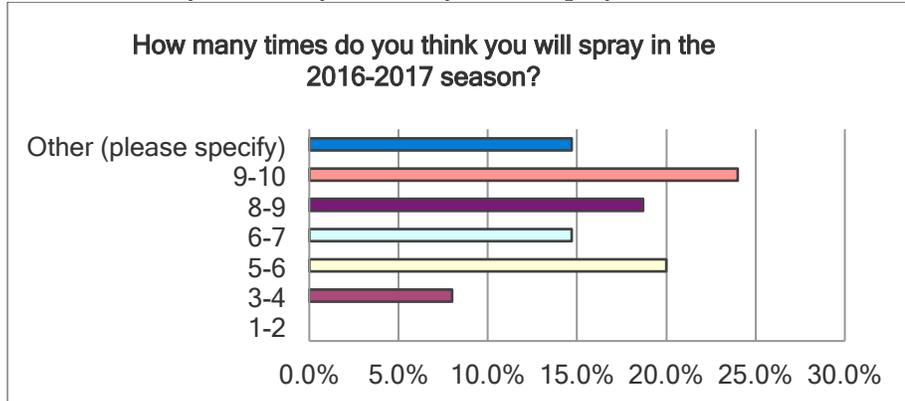
Over 95% of farms use Beauveria. BotaniGard is preferred 10 times more than Mycotrol O; only 5% don't spray.

Q46. When did you start spraying in the 2016-17 season?



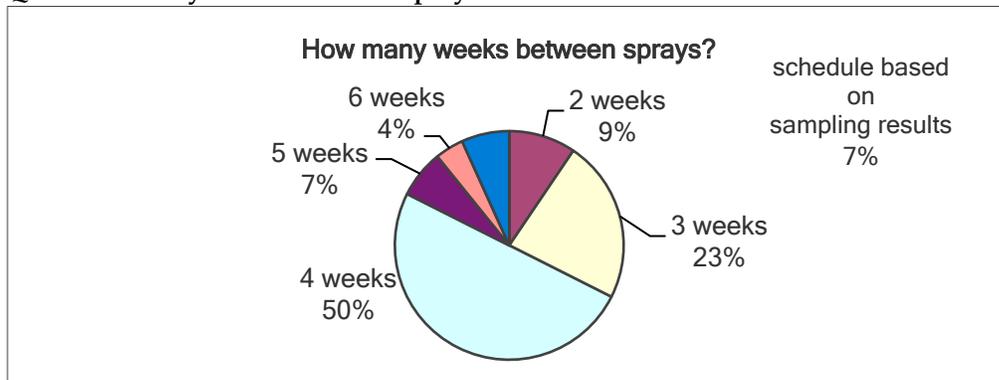
28% of farms report spraying for CBB in April; while nearly 50% begin spraying before April including 7% that spray year round. More farms began spraying earlier probably due to when flowering occurred.

Q47. How many times do you think you will spray in the 2016-2017 season?



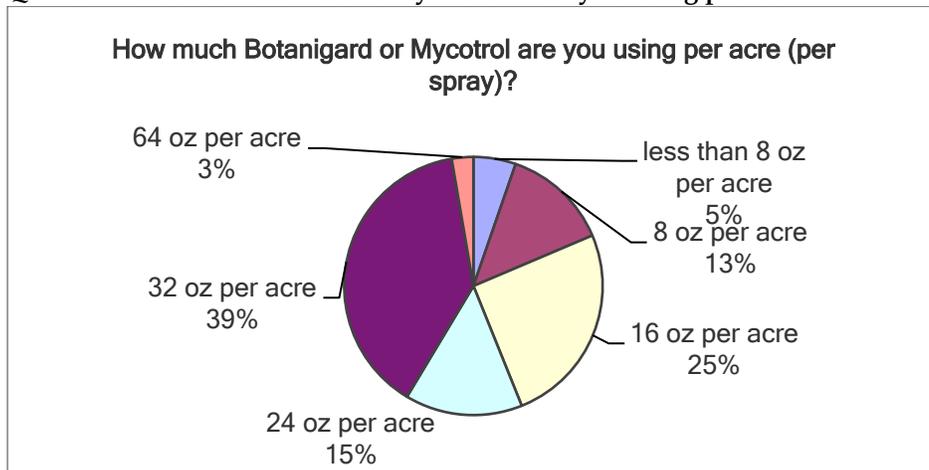
24% of farms expect to spray 9-10 times in the 2017 season. However number of sprays in the year depends on starting date and spraying interval. 73% indicated a 3 to 4 week interval.

Q48. How many weeks between sprays?



Responses were similar to 2015-16. 50% of farms spray every four weeks, 82% between 2 and 4 weeks, and 7% spray according to sampling results. Farms that spray based on samplings results reported 10.4% CBB infested cherry. Farms that spray every three weeks reported 11.4% CBB infested cherry and 22% green bean damage. Farms that spray every four weeks reported 12.3% CBB infested cherry and 35% green bean damage.

Q49. How much BotaniGard or Mycotrol O are you using per acre?

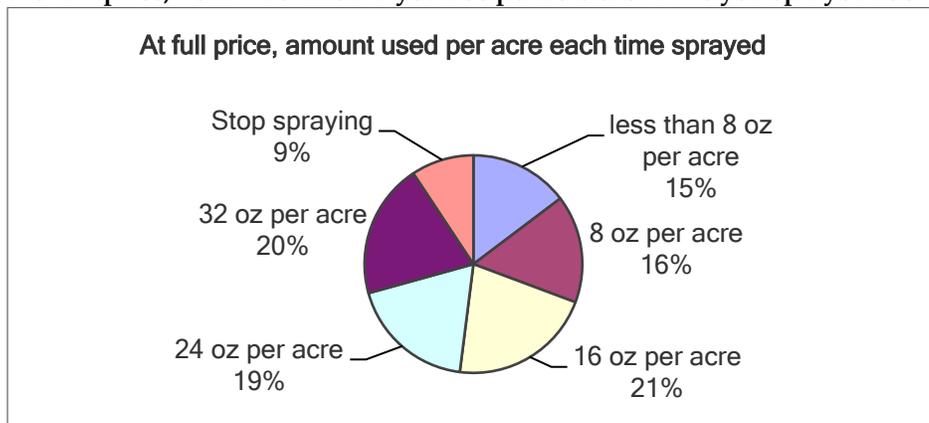


In the 2016-17 season, farms increased the amount of Beauveria product used per application. 39% of farms spray 32 oz per acre and 25% spray 16 oz per acre. Reported % CBB infested cherry and MGBRR for two rates of BotaniGard/Mycotrol were 11% CBB infested cherry and 6.9 MGBRR for 32 oz/acre and 15.5% CBB infested cherry and 10 MGBRR for 16 oz/acre in the 2015-2016 season.

Q50. How much spray solution (water plus Beauveria) do you apply (gallons per acre)?

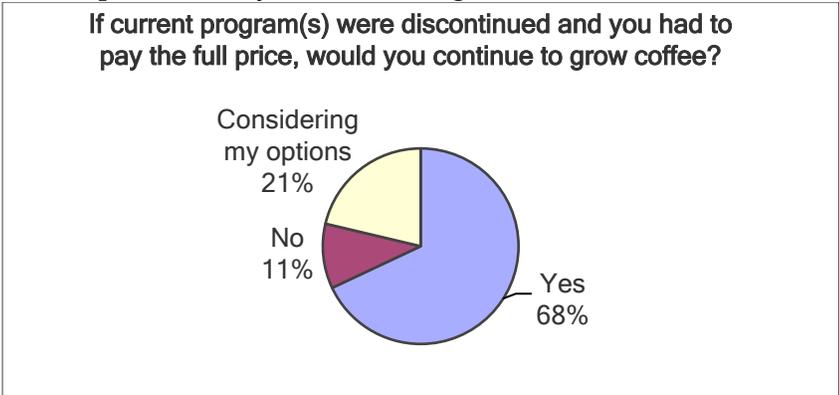
Spray solution per acre per spray averaged 36 gal/acre, the median rate was 30 gal/acre - 50% of farms sprayed 30 gals/acre or less, and 50% sprayed 30 gals or more.

Q51. If the current program to reduce the cost of BotaniGard or Mycotrol O were discontinued, and you had to pay the full price, how much would you use per acre each time you sprayed? Select an answer below.



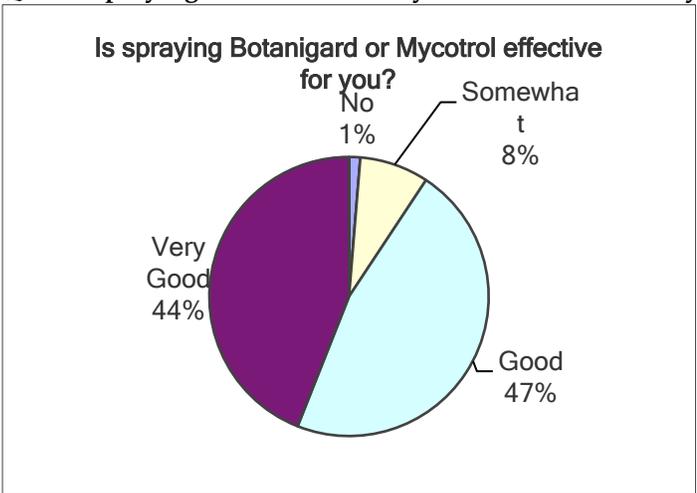
Without the subsidy, 9% would stop spraying, plus 71% would be spraying less than the recommended 32 oz per acre. CBB damage would increase and only strict sanitation could prevent large scale losses.

Q52. If the current program(s) to reduce the cost of BotaniGard or Mycotrol were discontinued, and you had to pay the full price, would you continue to grow coffee?



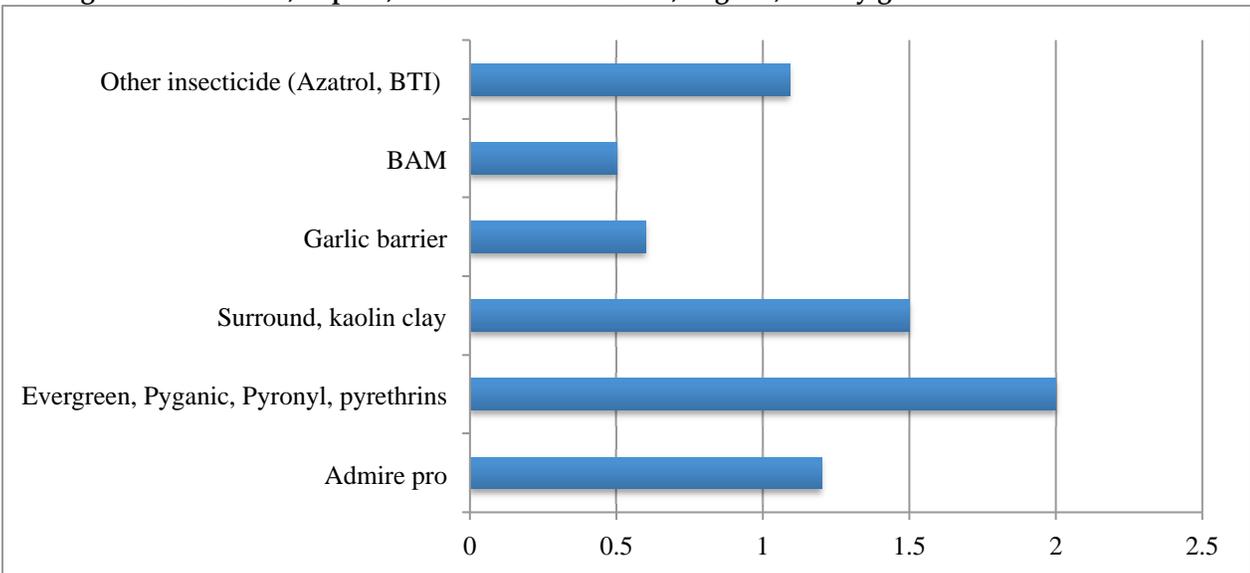
Without the subsidy 32% of farms would quit coffee or strongly consider it.

Q53. Is spraying BotaniGard or Mycotrol O effective for you?



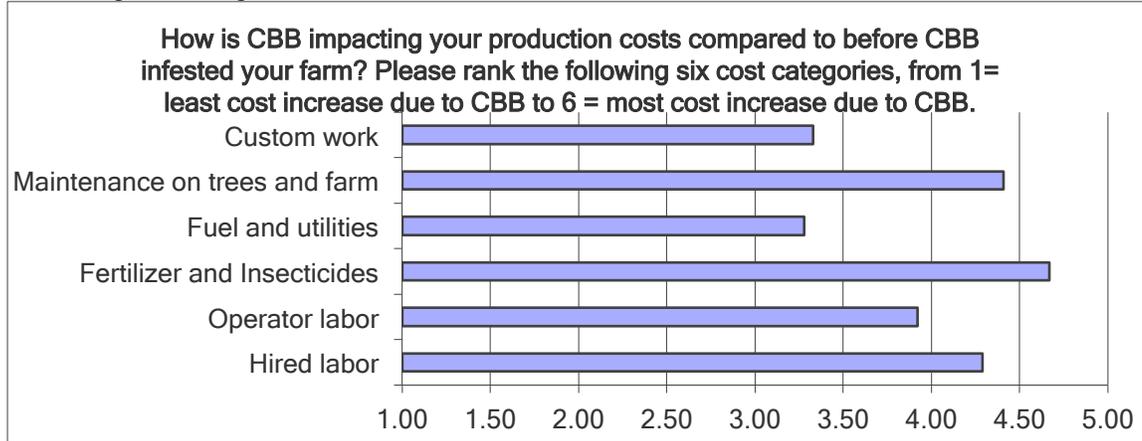
91% of farms find BotaniGard / Mycotrol effective.

Q54. If you tried other products to manage CBB, were they helpful?
 Scoring: 0=not effective, 1=poor, 2= somewhat effective, 3=good, 4=very good



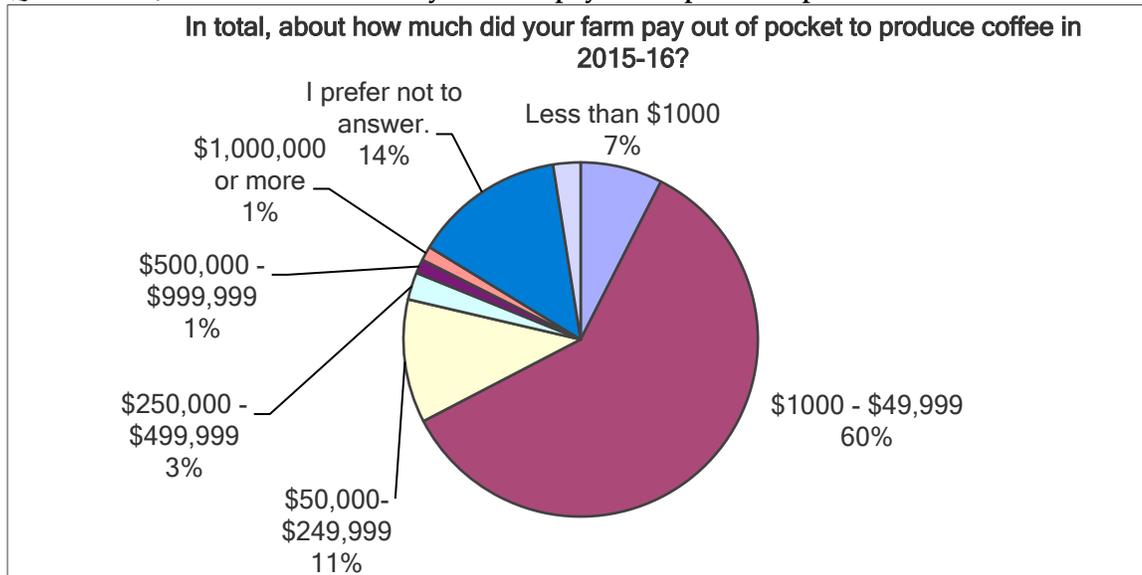
The 24 farms that tried Pyganic, Pyronyl or Evergreen rated it as somewhat effective. 12 farms found Surround or kaolin clay slightly less effective, and 10 found Admire Pro even less. One farm found Azatrol a neem concentrate effective. Garlic barrier and BAM were not effective.

Q55. How is CBB impacting your production costs compared to before CBB infested your farm? Please rate the following cost categories, from 1= least cost increase due to CBB to 6 = most cost increase due to CBB.

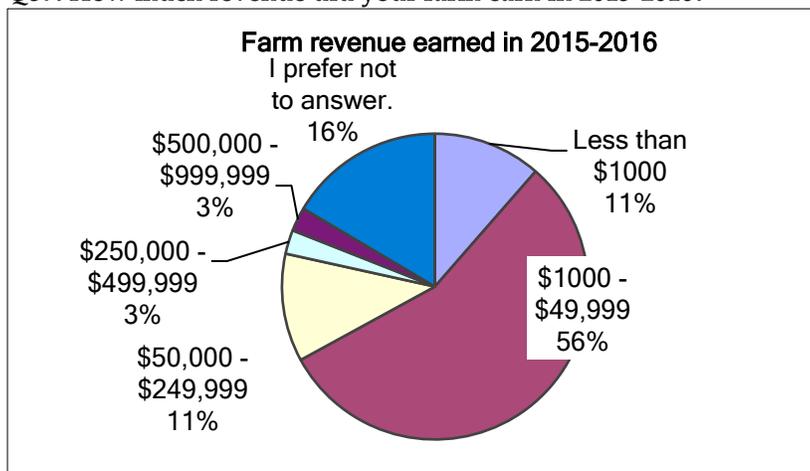


Insecticide costs (BotaniGard or Mycotrol), followed closely by maintenance of the trees (sanitation focused harvest and end-of-season strip harvesting costs) and hired labor costs had the greatest increase due to CBB infestation.

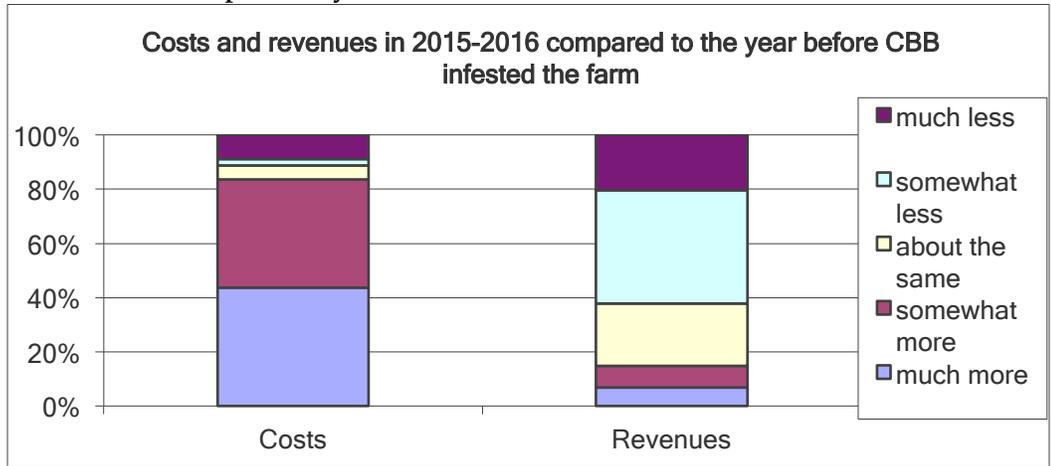
Q56. In total, about how much did your farm pay out of pocket to produce coffee in 2015-16?



Q57. How much revenue did your farm earn in 2015-2016?

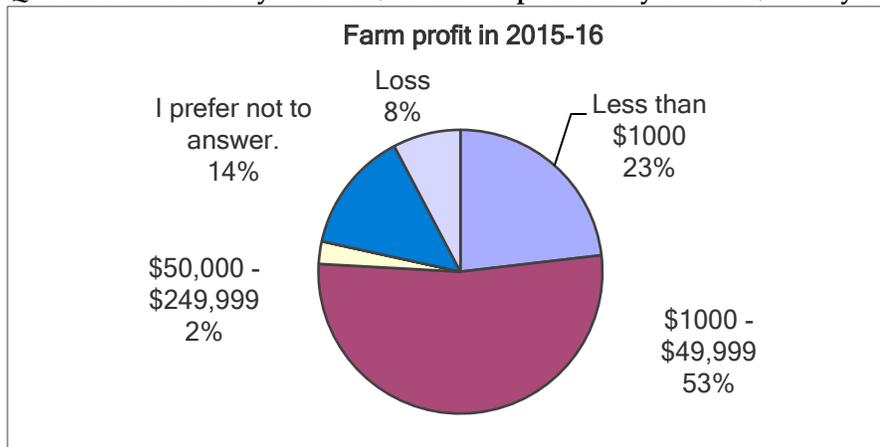


Q58. How did the costs and revenues in 2015-2016 compare to the year before CBB infested your farm? Select the choice that best represents your situation.



Over 80% of farms experienced much more or somewhat more costs compared to before CBB arrived, over 60% experienced much to somewhat less revenues after CBB arrived.

Q59. How much did you clear (how much profit did you make) from your coffee farm in 2015-16 harvest season?



Farms on Big Island who responded said 8% had a loss in the 2015-16 crop, a decrease from 30% in the 2014-15 season. An additional 23% made less than \$1,000 profit.

Q60. Do you have observations on CBB control that you want to share?

Strip picking and spraying most effective.
 IPM method works well.
 Timing of insecticide application is best determined by insect activity NOT calendar.
 Post and pre harvest stripping are key to control.
 Botanigard is very effective. It is very expensive. It requires much labor to spray. Farmers need every subsidy available to afford. Request state offer more subsidies especially if federal program terminates.

Spraying Botanigard improves the quality of the coffee beans
 The best method to control CBB is to manually remove and destroy CBB berries and use Botanigard regularly. Also must maintain and clean farm of extra beans (dried, dropped).
 We have found it helps spraying after each harvest
 If you do not spray monthly, you will be sure to have beetle damage as CBB multiply rapidly.
 Have sprayed for CBB every 2 weeks at the on set of new berries during the afternoon swarming time.

The wetter the season the less impact from CBB
 2015-16, Highest CBB counts in coffee near nut orchard. Second highest in area where trees have burst fruit and dropped fruit.
 Infestation mostly in shady lower part of trees.
 CBB are active after rain - it is good to spray righter after in rains when they fly.

Need Chemical for ground treatment.

Pure Cinnamon oil, post-season, works very well as a ground-spray. Azatrol and BTI work well to prevent reproduction in rotten cherries [kills the larva].

Q61. What research do you want done about the CBB problem?

Optimal timing determination for insecticide application.

What is the least amount of Beauveria that needs to be sprayed to get less than 5% CBB?

More on what is the most effective way to spray Beauveria, amount/acre and timing throughout season.

More research on the amount of surfactant amounts and types, because we see leaf tip burning on new growth.

How to eradicate in the off season.

What to do best for cherry dropped and left on ground, how to treat the fallen cherries best, if not picking them up. mulch? groundcover, chemical, heat

Would like to see a standard method for defining CBB damage by processors. Many CBB have been killed prior to penetrating the bean, but still leave the puka on the bean. A standard methodology should be developed that would be used across all processors (and could be used by a farmer) to estimate the CBB bean infestation that will result in a lowered cherry price.

More biological control study

Natural predators

Figure how to make infertile female CBB just as was done with the fruit fly. Same with the twig borer cause we think they do just as much or more damage if the whole twig of cherries are dried up.

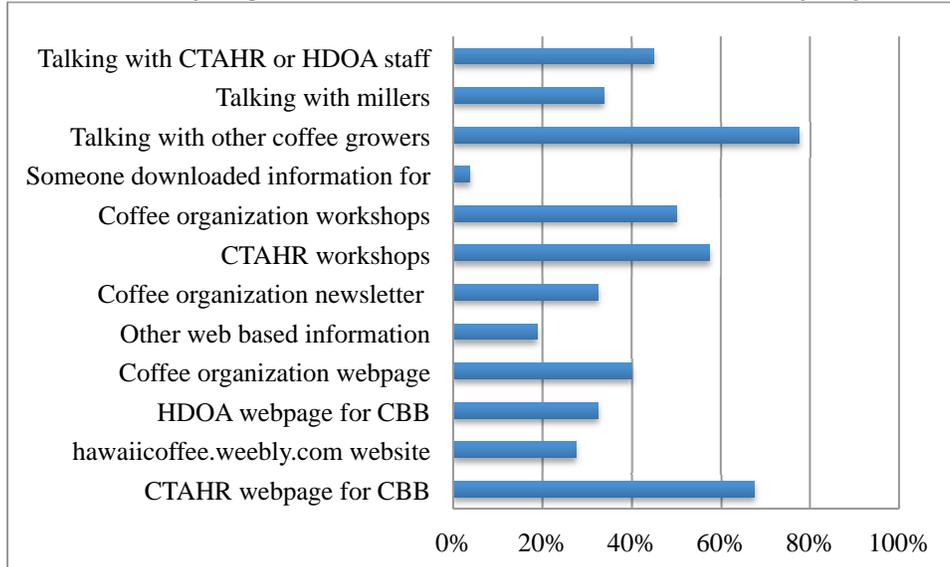
Q62. Are you planning to stop growing coffee because of CBB?

6% of responding farms said they will stop growing coffee, 82% are continuing in coffee and 12 % are considering quitting. This similar to 2015.

Q63. How many farmers do you know have stopped farming coffee?

51% of farmers knew 1-4 farmers leaving coffee due to CBB and 11% knew more than 5 farmers were quitting; only 38% said they didn't know anyone leaving. This is similar to last year.

Q64. Where do you get information to control CBB? Select as many as you use.



Talking with other growers (78%) is the most source of communication, followed by CTAHR web pages (68%) incl. hawaiicoffee.weebly.com, CTAHR workshops (58%).

Q65. How are you measuring CBB damage on cherry you purchase in 2016-17 season?

Majority of buyers do a random sample of cherry, and some pulp and examine wet parchment.

Q66. For the cherry you purchased last season (2015-16), please estimate the marketable green bean recovery ratio (cherry weight divided by marketable green bean weight).

Half of cherry buyers estimated MGBRR of 7 (22% green bean loss), others reported values that were lower than the pre-CBB MGBRR.

Q67. As a processor do you have comments?

Yes, we notice that farms that do not spray regularly show tremendous damage, versus those that spray.