College of Tropical Agriculture and Human Resources
University of Hawai'i at Mānoa

CTAHR's Coffee Research and Extension Update 2013

A focus on CBB

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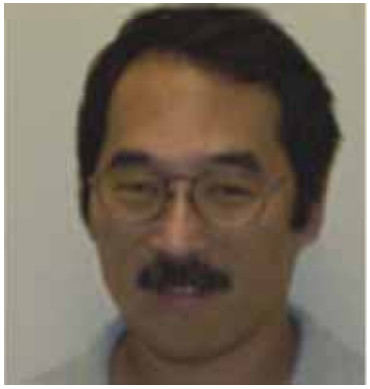
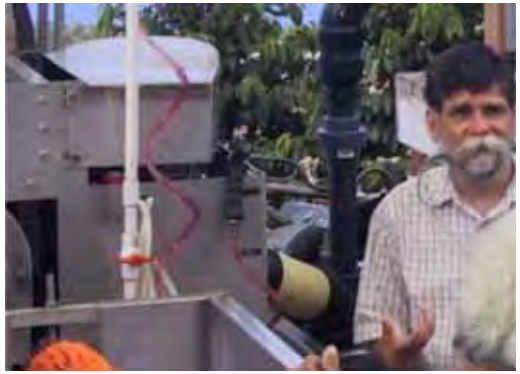
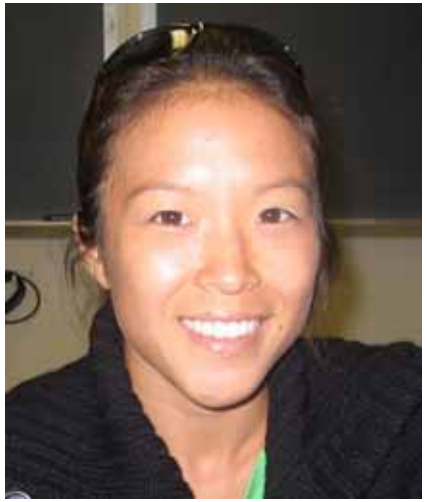
Key CTAHR personnel working with coffee around the State



Dr. Stuart Nakamoto
Ag. Economist



Dr. Loren Gautz
Biological engineer



Andrea Kawabata
West Hawaii Extension Agent

Marc Meisner
Kona Stn. Manager

Dr. Mark Wright
entomologist

Dr. Elsie B. Greco
entomologist

Dr. Russell Messing
entomologist

Also Dr. Mike Kawate, Richard Ebesu, Dr. Scot Nelson, Jari Sugano

Coffee pesticide registration
Dr. Mike Kawate

Registration status:

Cyantraniliprole (Cyazypyr) – For CBB control. Field residue trials were completed in 2012, samples are being analyzed.
NOTE: Recent report from Indonesia found damage of green bean reduced from 30% to 5%.

Spirotetramat (Movento) – For green scale control, HDOA will approve Supplemental label soon.

Imidacloprid (Admire Pro replaces Provado 1.6 Flowable) it can be applied as a foliar or drench. Controls green scale. NOTE: Elsie Greco reported to HCA in 2010 that it reduces Black twig borer damage.

Pyrethrins and piperonyl butoxide (Pyronyl Crop Spray) for quick knock down of CBB and post harvest storage pests like Almond moth. Reregistration includes analysis for residues in roasted and freeze-dried coffee following 10 applications including day of harvest.

Spinosad (Success, Entrust) – For coffee leafminer control. (HI is looking at this product for banana moth control.) IR-4 final report (tolerance petition) is under review with Quality Assurance and the manufacturer (Dow AgroSciences).

CBB Laboratory Bioassay of Effectiveness of Insecticides

EverGreen Crop Protection EC 60-6

Good direct contact activity. No indirect activity.

Cyazypyr

Poor direct contact activity. Good indirect activity (possibly from limited ingestion of the insecticide when CBB bores into berry).

Provado

Poor direct contact activity. Moderate to good indirect contact activity (may have repelling or anti-feeding activity), but somewhat inconsistent.

Movento

Poor direct contact activity. Poor indirect contact activity.

Success

Some (inconsistent) contact activity. Moderate to good indirect contact activity, but inconsistent.

Sniper

Good direct contact activity (expected). Good indirect contact activity. NOT labeled for coffee.

Bioassays on the remaining insecticides in the list are ongoing.

In-orchard sleeve tests of indirect exposure of CBB to pesticide:

Select laterals, remove CBB infested cherry, spray cherries, net sleeve added, 25 CBB added, after 4 wk all infested cherry picked and opened to count live, dead, ill CBB in all stage- egg to adult.

Cyazypyr was very effective.

Tolfenpyrad, spinosad and pyrethrins were not.

Coffee Berry Borer: Seasonal fluctuations, traps, fungus and insect repellence

Elsie Greco

<eburbano@Hawaii.edu

Outline

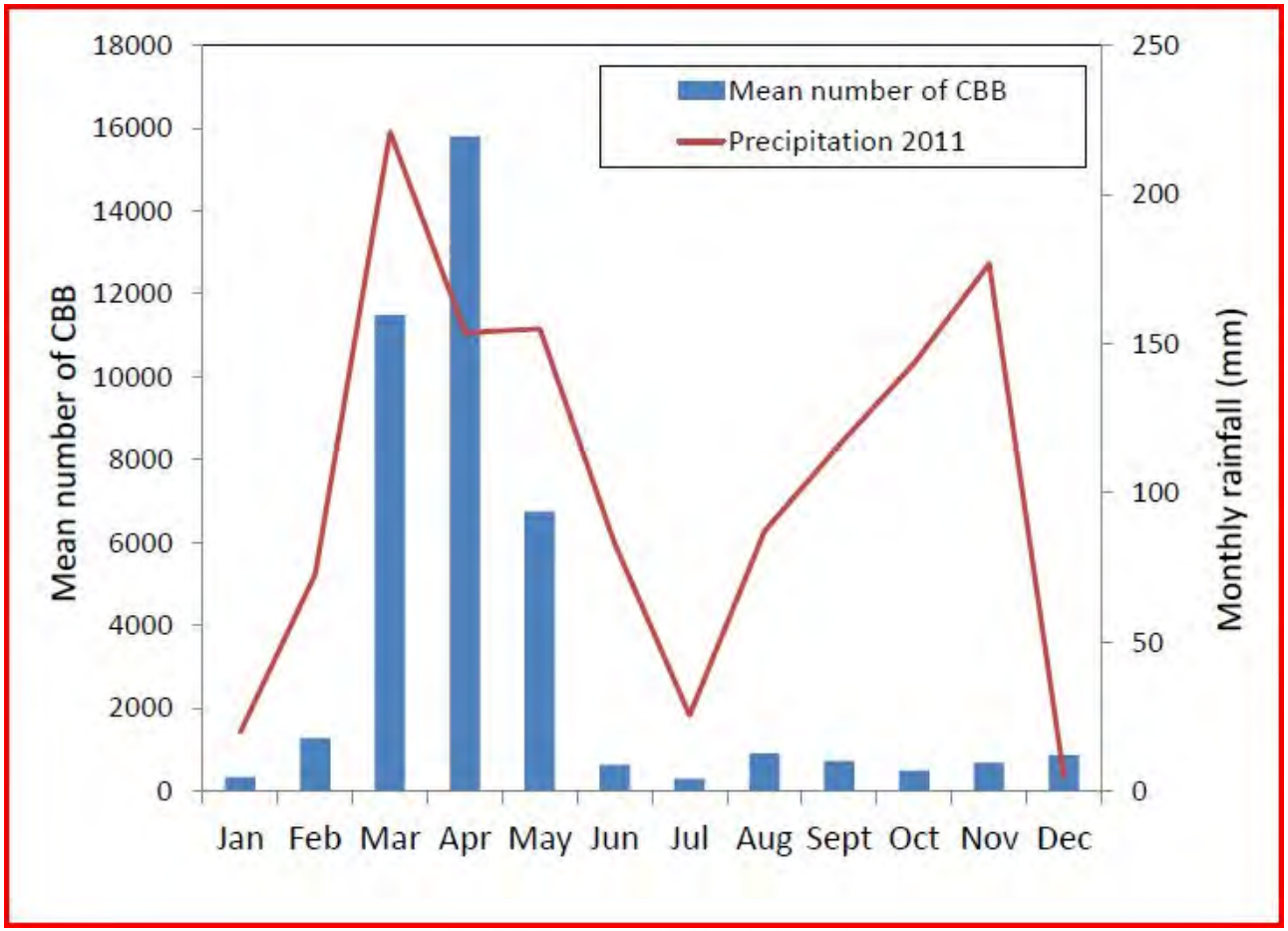
1. Seasonal Fluctuation of Coffee Berry Borer
2. Effect of trapping height
3. Effectiveness of Botanigard® (*Beauveria bassiana*)
4. Effectiveness of Surround® WP

1. Seasonal Fluctuation of Coffee Berry Borer

Purpose: Determine the flight pattern of CBB

- 10 Japanese Beetle Traps
- Attractant: methanol: ethanol (3:1)
- Height trap: 4.9 feet
- Killing agent: Vaportape
- Trapping and counting monthly in 2011

1. Seasonal Fluctuation of Coffee Berry Borer



1. Seasonal Fluctuation of Coffee Berry Borer

Summary:

- CBB populations were present all year round.
- Peak flight occurred in April.
- After May, the number of females caught in traps decreased drastically (due to greater attractiveness of maturing cherry) and remained low until the next spring.
- Largest CBB captures were correlated with coffee flowering and high rainfall; but likely triggered by flowering phenology (no second peak occurred with late-year rains).

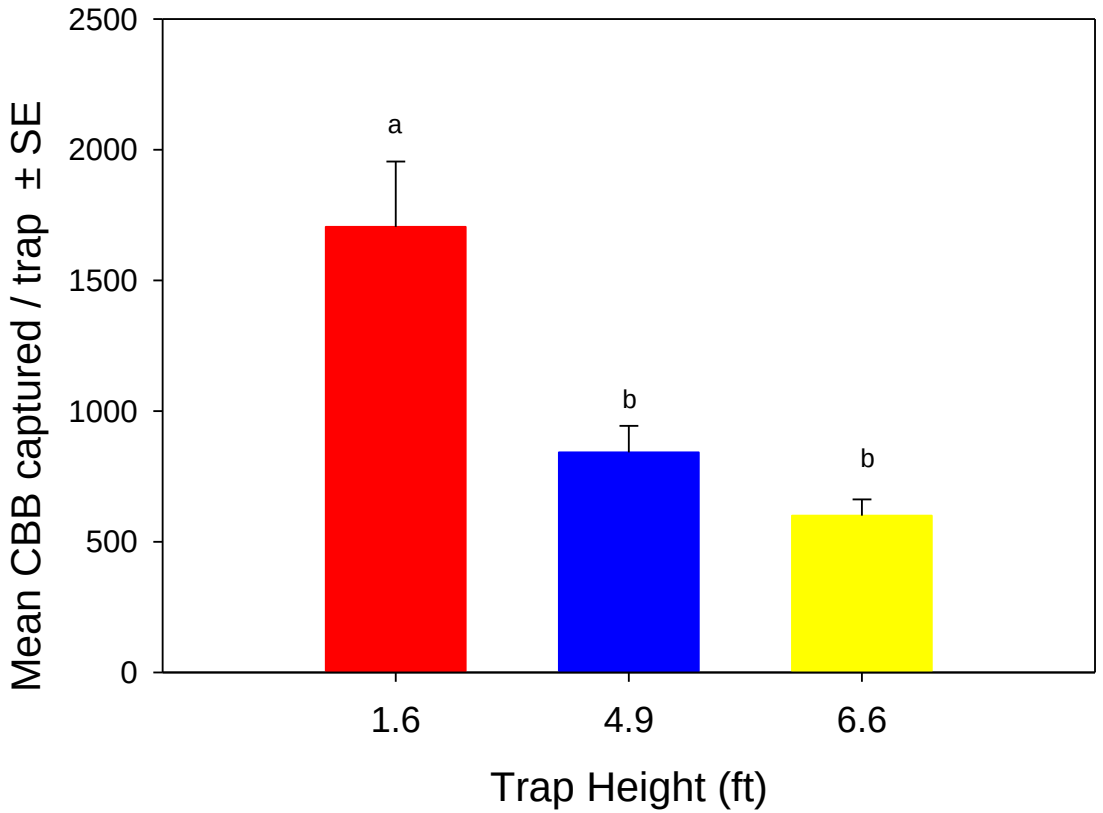
2. Effect of trapping height (at 1550 ft elevation)



Purpose: To determine the best height above ground for the baited traps

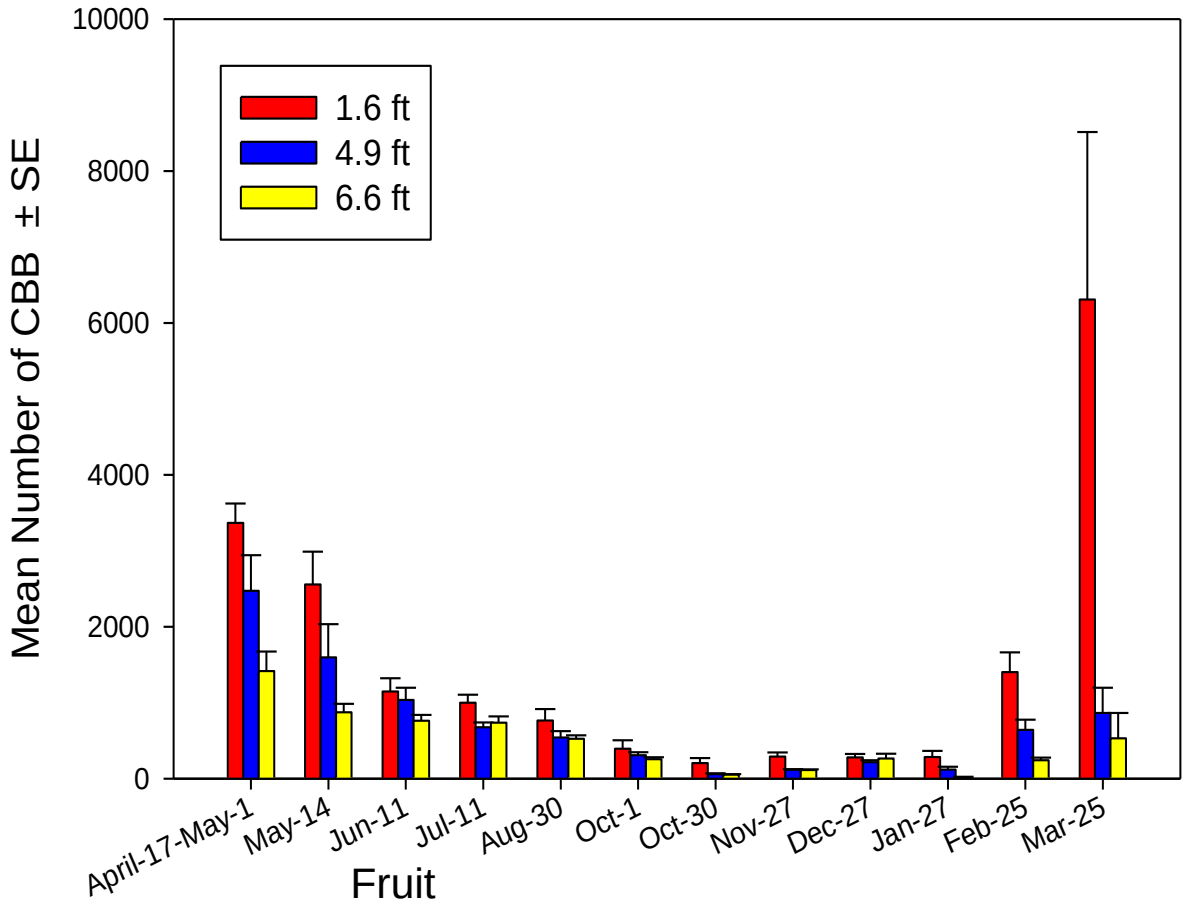
- Height: 1.6, 4.9 and 6.6 feet
- Ten traps per height
- Monitored monthly
- Trapping from April 17, 2012 to March 25, 2013

2. Effect of trapping height (at 1550 ft)



Means with the same letter are not significantly different, $P < 0.0005$

2. Effect of trapping height



Main flowering: May 8

Harvest

Pruning: February

2. Effect of trapping height

Summary:

- Significantly higher CBB capture in traps located at 1.6 ft
- The same pattern was observed throughout the year
- Significant CBB capture was observed from February to May (flowering) and numbers were reduced during fruit development and harvest season
- Baited traps are highly effective after pruning and before the fruit development season

3. Effectiveness of Botanigard®

- Purpose

  - Determine the effectiveness of three doses of Botanigard ® at different elevations (2502, 1550 and 476 ft)

  - Effectiveness of the Botanigard depending upon the position of the female (A, B and C)

  - Presence of immature stages for future releases of natural enemies

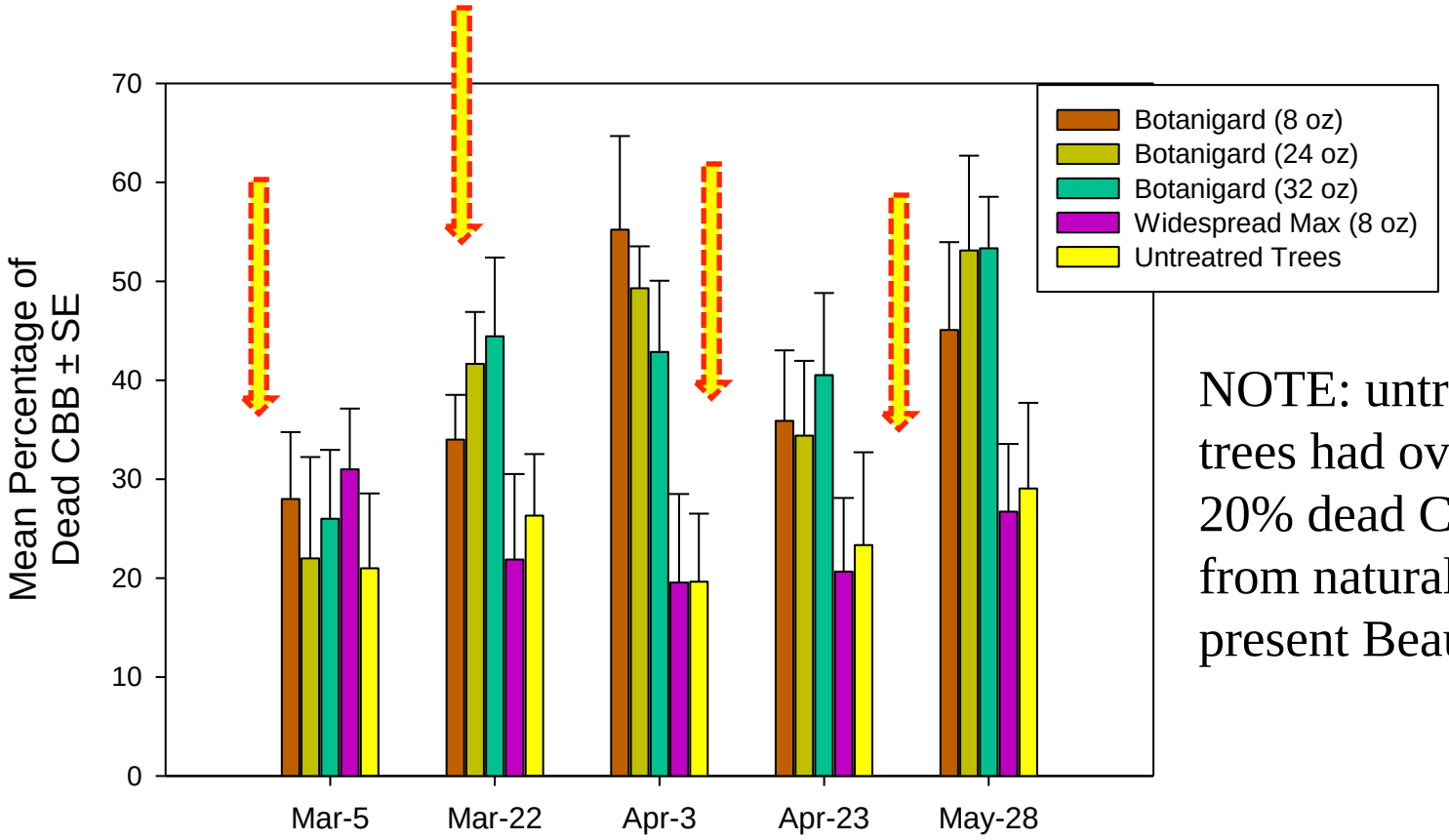
- Treatments
  - Control (untreated trees)
  - Botanigard® (8, 24 and 32 oz + 8 oz Widespread Max / acre)
  - Widespread® Max
- 3 replicates per farm
- Spraying with backpack not mist blower
- Harvested berries two weeks later and dissected

Position A: Visible female's abdomen

Position B: Initial damage to the endosperm

Position C: Invasion and damage of the endosperm

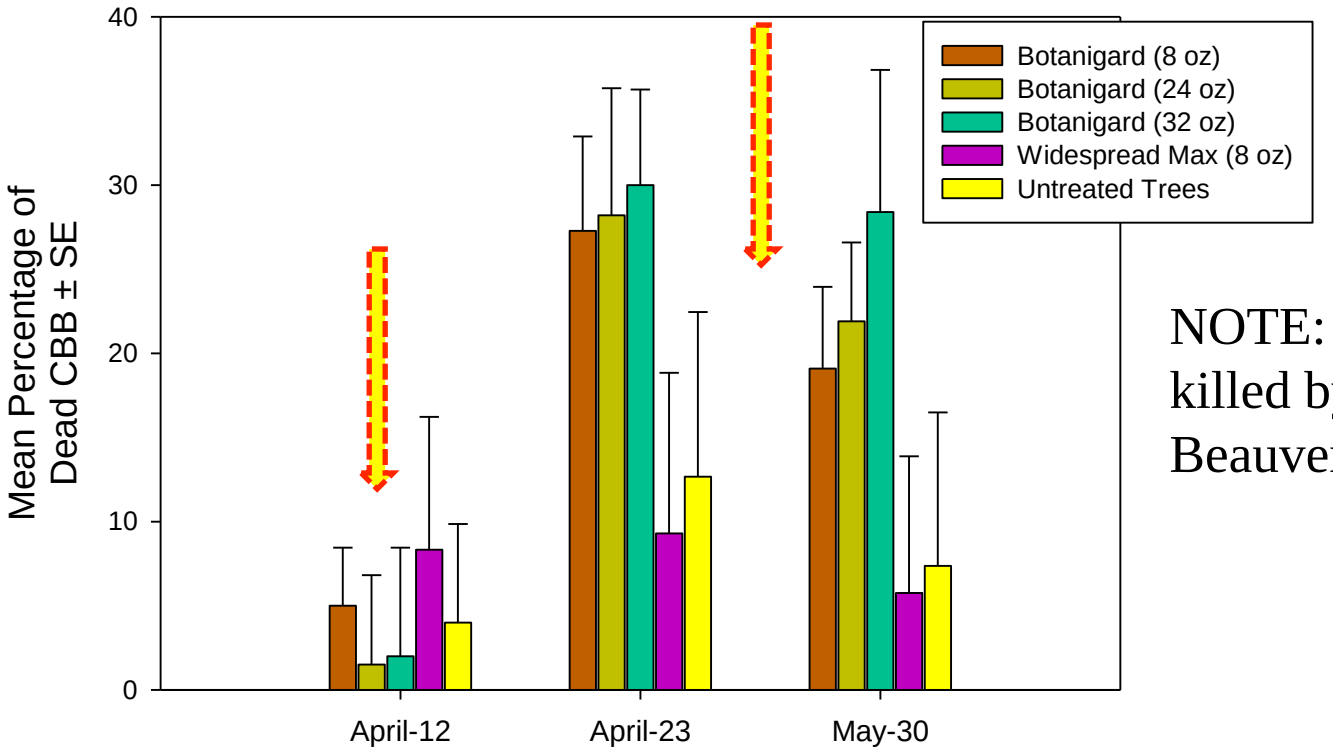
3. Effectiveness of Botanigard®: three rates at 2502 ft



NOTE: untreated trees had over 20% dead CBB, from naturally present Beauveria.

Spraying dates: Mar 4, Mar 22, April 3, May 16

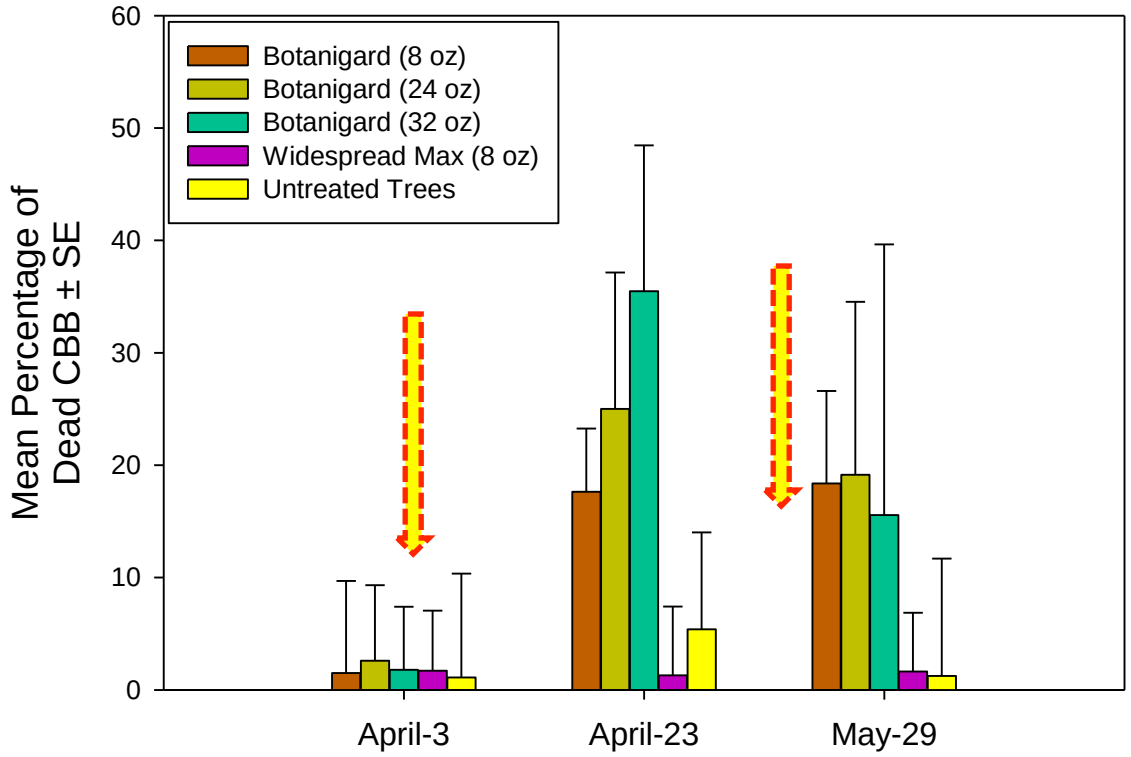
3. Effectiveness of Botanigard®: three rates at 1550 ft



NOTE: 10% CBB killed by natural Beauveria.

Spraying dates: April 12, May 6

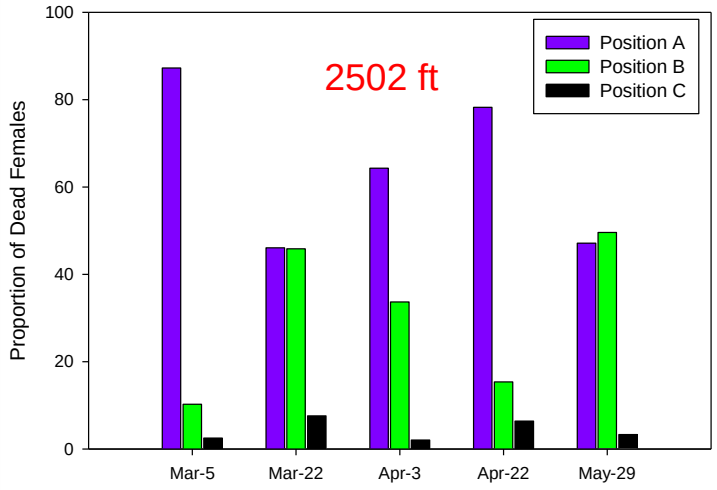
3. Effectiveness of Botanigard®: three rates at 476 ft

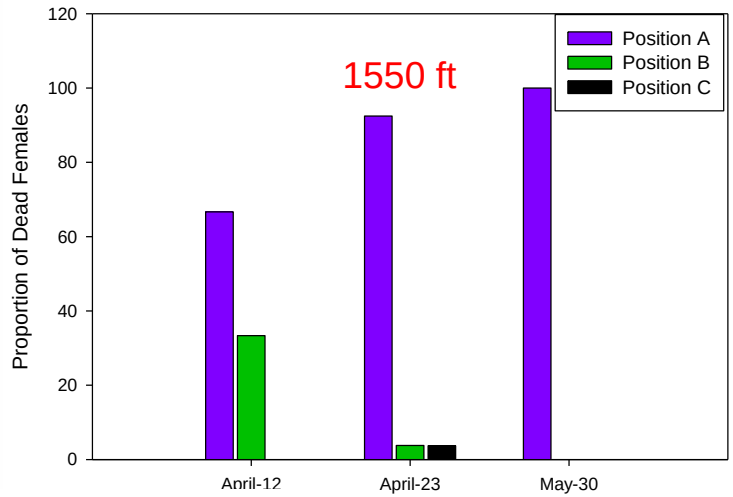


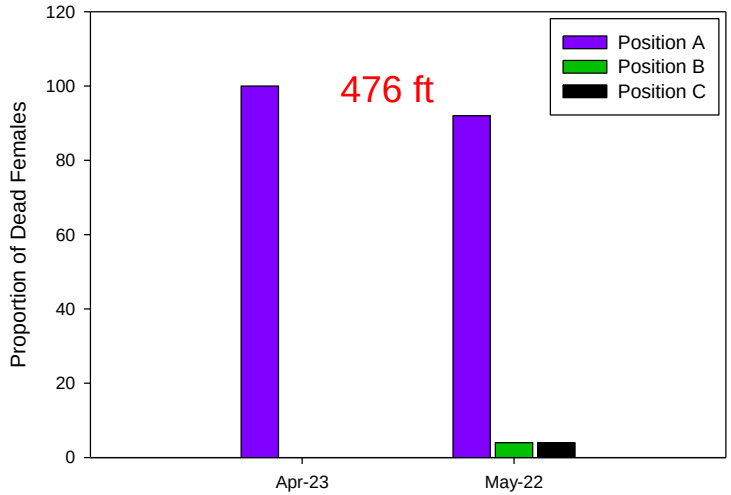
Spraying dates: April 3, May 10,

NOTE: <5% CBB killed by natural Beauveria.

3. Effect of elevation (temperature) on female position in coffee cherry

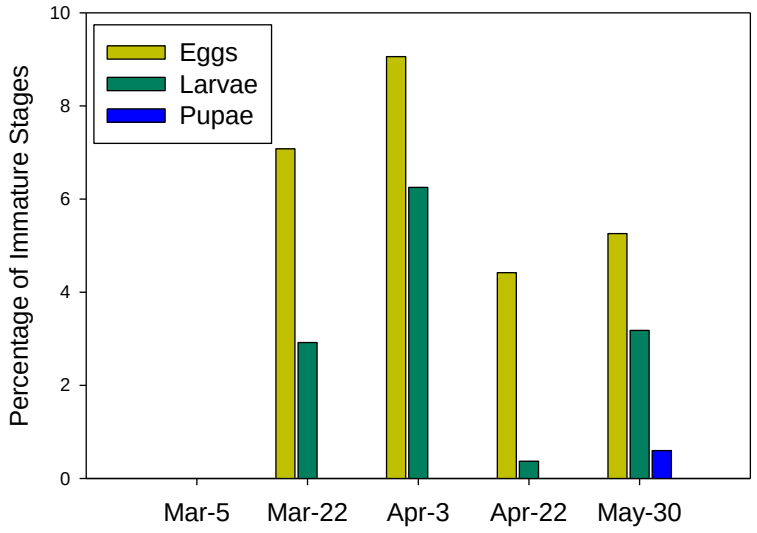




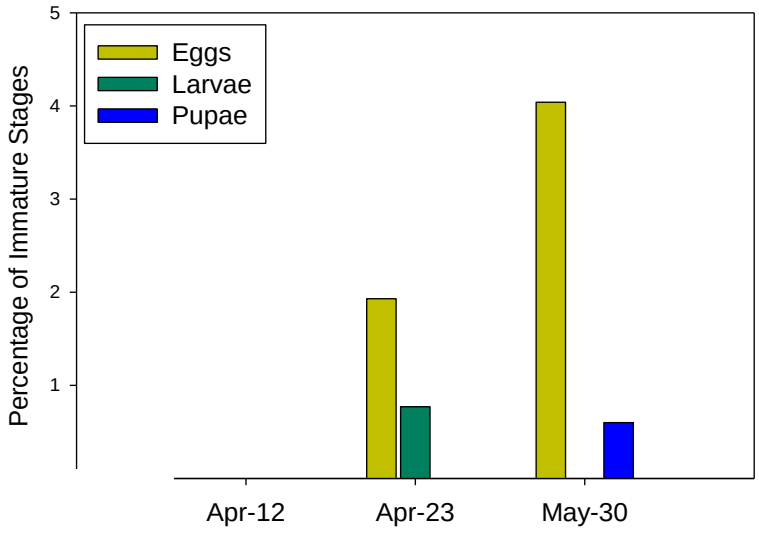


3. Presence of immature stages at different elevations (temperature)

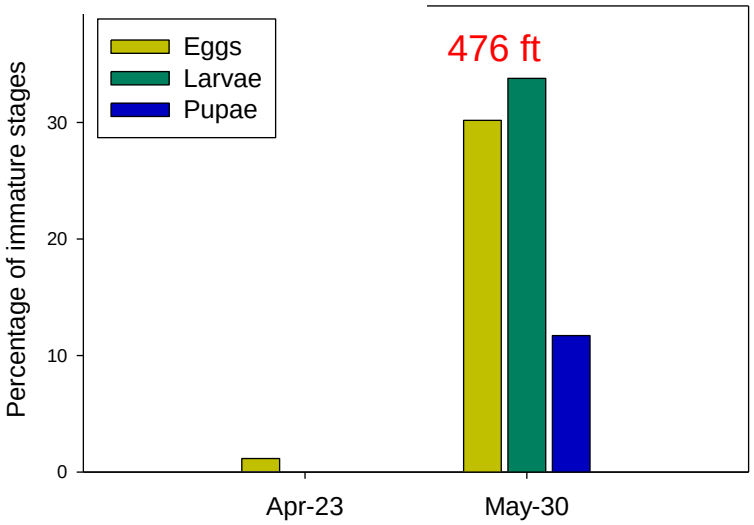
2502 ft



1550 ft



476 ft



NOTE: CBB grows much faster and earlier at lower (warmer) elevation.

3. Effectiveness of Botanigard®

Summary:

- *B. bassiana* was found naturally at 1, 5 and 20 % at farms located 476, 1550 and 2502 ft respectively.
- Percentage of CBB mortality was not affected by the experimental concentrations (8, 24, 32 oz/acre) of Botanigard applied
- With monthly spraying, the effectiveness of Botanigard was approximately 20% in all of the farms
- Botanigard was most effective:

  - at the early stages of CBB attack (beginning of the fruit development)

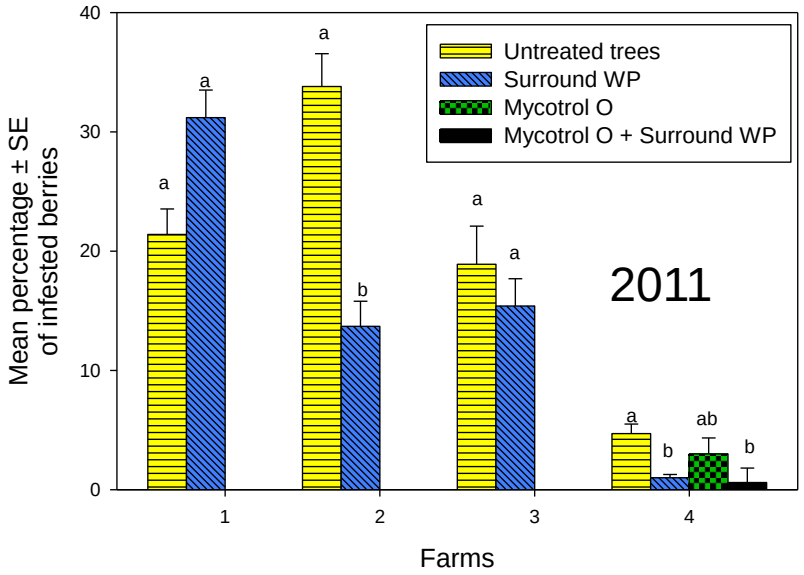
  - A position--visible female's abdomen

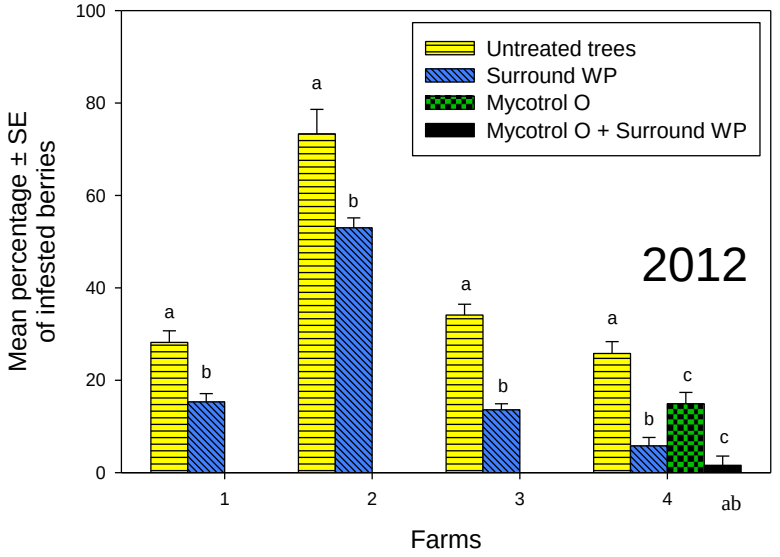
  - B position-- initial damage to the endosperm
- Botanigard was less effective at C position (invasion and damage of the endosperm)
- Immature stages were observed in March, April and May, higher populations were seen earlier at lower elevations.

4. Effectiveness of Surround® WP ('organic' kaolin clay)

- 2 year project with Shawn Steiman
- 4 farms
- Purpose
  - Control CBB
  - Increase yields over 2 year cycle
- 6-tree experimental units
- 3 replicates per farm
- Treatments
  - Control (untreated trees)
  - Surround® WP (1 liter of water + 50 g of Surround® WP + 3 ml of Nu Film P ®)
  - *Beauveria bassiana* (Mycotrol® O)
  - Surround® WP + Mycotrol® O
- Spray trees every 2 weeks
  - 6 weeks after flowering until end of harvest

4. Effectiveness of Surround® WP





NOTE: in 2011 farms 1 & 3 did not spray regularly.

Insufficient coverage

Good coverage

4. Effectiveness of Surround® WP

Farm	Treatment	Total Cherry Yield/18 trees (Kg)	
		Year	
		2011	2012
1	Control	5.4 a	10.6 a
	Surround WP	4.3 a	13.9 a
2	Control	30.7 a	35.6 b
	Surround WP	46.1 a	41.2 a
3	Control	NA	NA
	Surround WP		
4	Control	12.4 ab	13.4 a
	Mycotrol O	9.2 b	16.7 a
	Surround WP	22.2 a	24.8 a
	Surround WP + Mycotrol O	18.6 ab	23.3 a

Different letters within a column and farm are significantly different at $p < 0.05$

4. Effectiveness of Surround® WP

Summary:

- There were significantly less infested berries on plants sprayed with Surround ® WP than on control plants only on the farms that sprayed biweekly and had a good coverage.

- In 2011, coffee berries were harvested in the experimental plots prior to our assessment, therefore, yield estimates were compromised. In 2012 there was a trend toward an increase in coffee yield in plots treated with Surround ® WP compared with the untreated plots.

- Surround ® WP has potential as a barrier to reduce CBB attack, and it can be used as an alternative tool in an integrated management against CBB, and may offer an alternative management option for organic coffee growers as well.

- Good coverage is essential to protect the berries from the CBB attack thus multiple applications may be required. NOTE: Estimated material cost per application per acre is $52= 25 lb Surround $37 plus 1 qt NuFilm $15 .

Overall Summary

- CBB was captured throughout the year. Peak populations observed from March to May
- Combination of trapping (Feb-May), trap height at 1.6 ft, *B. bassiana* and Surround ® WP are recommended as components of an IPM program.
- The effectiveness of the products tested will depend on spray coverage, frequency, application rates, insect population and weather conditions.
- They are more effective when used early in the fruit development cycle, before the population outbreaks occur
- Hot-spot infestations should be treated with insecticides or other appropriate IPM actions such as sanitation
- Sanitation and regular harvesting must also be conducted

NOTE: open cherry containers should closed to prevent CBB escape.

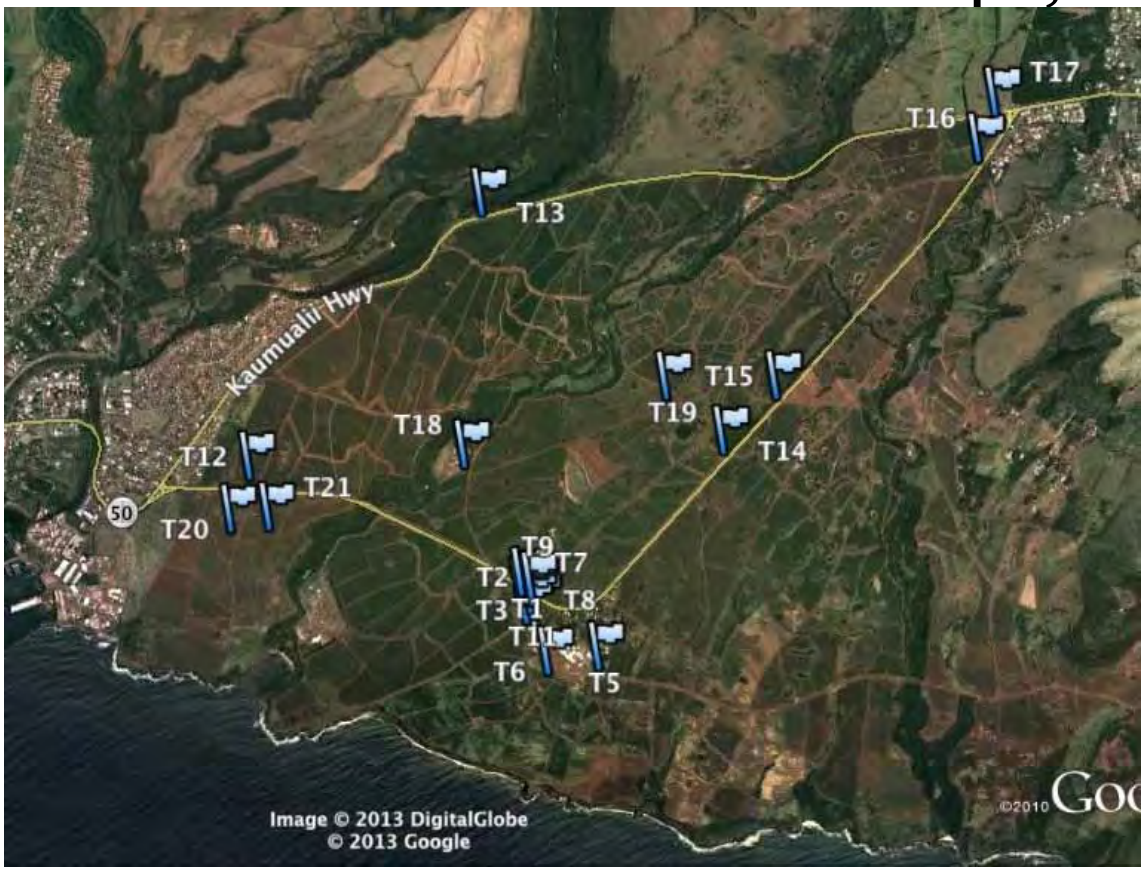
MAHALO !

- Brooks and Bill Wakefield: Wakefield & Sons
- Consuelo Lemus, Noylin Vargas, Riann Parong, Roxane Delos Santos
- Dave and Trudy Bateman, Miguel and Lupe Mesa: Heavenly Hawaiian
- Randy Blades: Koa Coffee
- Steve McLaughlin, Jason Heiret: Captain Cook Coffee
- Shawn Steiman: Coffea Consulting
- Dawn and Robert Barnes, Joenell Nullar: Rainforest Coffee
- Bob Nelson and Brian Axelrod: Lehuula farms
- Bob Foerster: Dragon's Lair State
- Ronald and Mary Lake

WESTERN SARE Sustainable Agriculture Research & Education

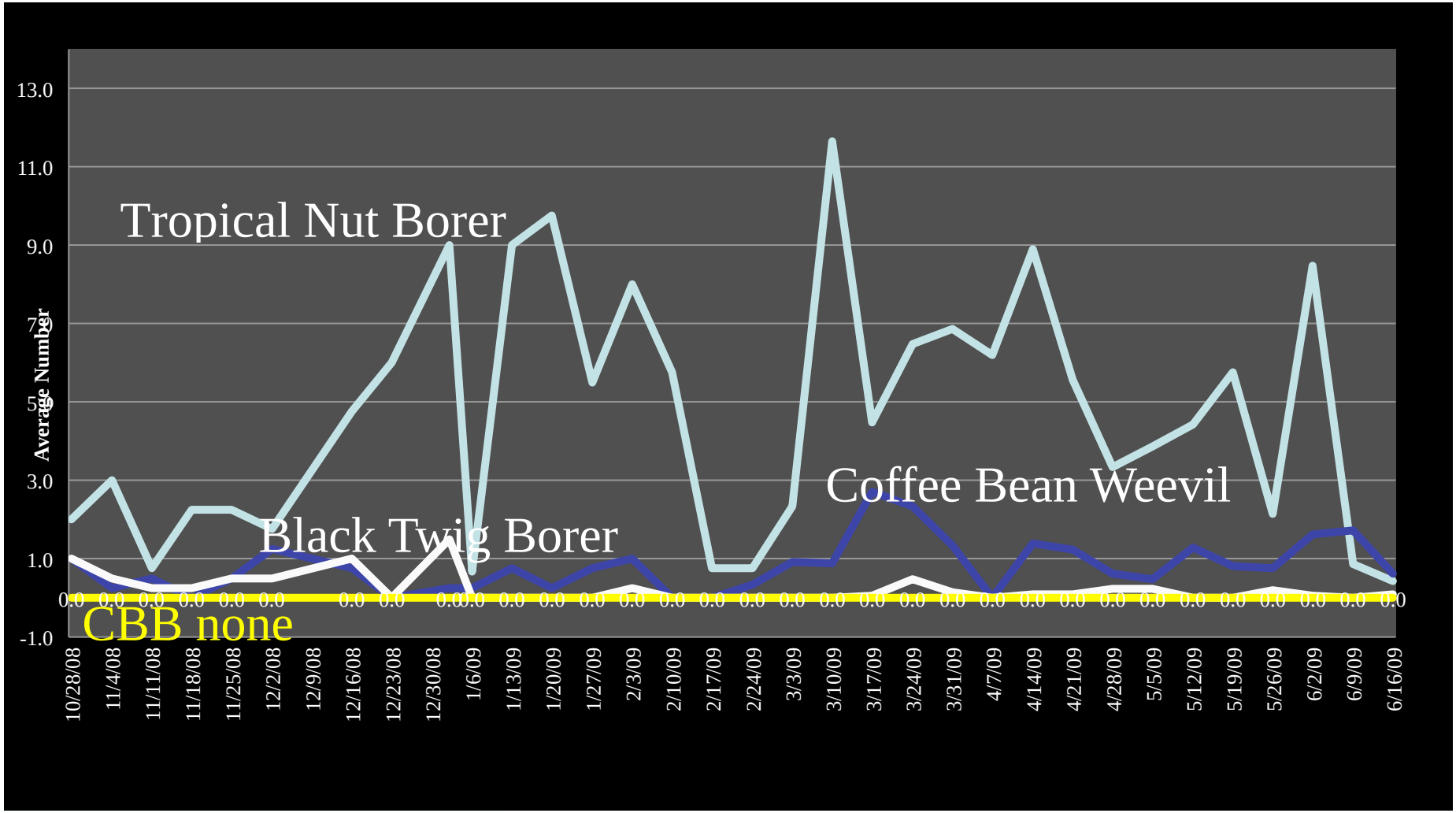
Russell Messing
<messing@hawaii.edu>

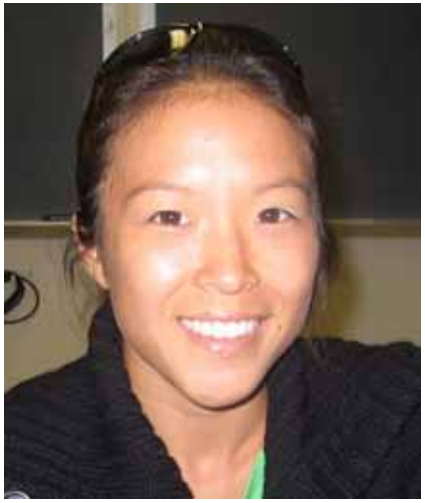
Trapping at Kauai Coffee for about 8 months. 21 traps, serviced weekly.



Traps near Visitor Center, Mill and along roads.

Trapping at Kauai Coffee





Andrea Kawabata <andreak@hawaii.edu>
West Hawaii Extension Agent

Working with the Local and Immigrant Farmer Education (LIFE) Program, Risk Management School and Risk Management Hawaii Projects.

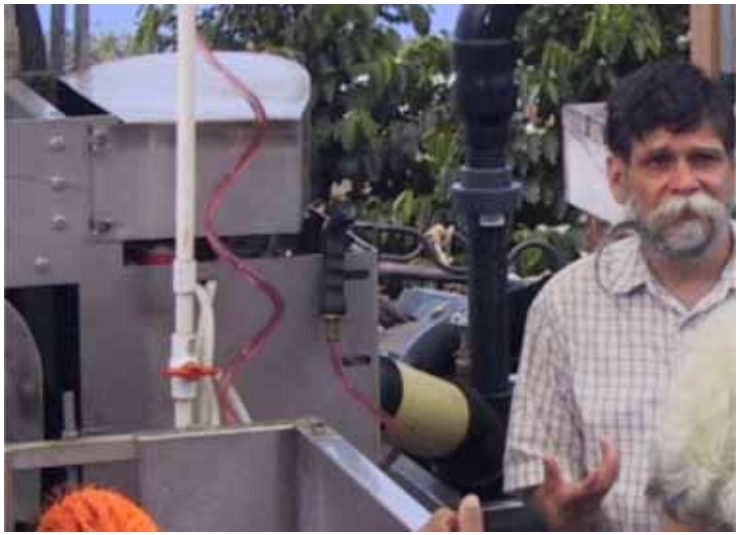
Andrea and Jr. Extension Agent, Ryan Tsutsui, have provided 15 workshops and field days to coffee growers with topics ranging from Coffee Berry Borer management and coffee leaf and soil sampling, to managing Little Fire Ants, recordkeeping and crop insurance, farm taxes, and labor laws. Andrea and Ryan have also provided public awareness of coffee and coffee pests and diseases at several conferences, expos, and festivals.

Andrea, Stuart, and Ryan are conducting statewide educational workshops and field days to promote awareness of CBB and IPM techniques.

Stuart (extension economist) and Andrea organized a CBB Summit for CTAHR and USDA, HDOA, and coffee industry and educational leaders to discuss CBB IPM how to improve these. “Recommendations for Coffee Berry Borer IPM in Hawaii 2013” which is endorsed by 12 organizations who are directly involved with the coffee industry. Can be downloaded from CTAHR http://www.ctahr.hawaii.edu click on Coffee Berry Borer.

Dr. Stuart Nakamoto
Ag. Economist
<snakamo@hawaii.edu>

Coffee Engineering



Dr. Loren Gautz
<lgautz@hawaii.edu>
Andrew Bowles, M.S. student

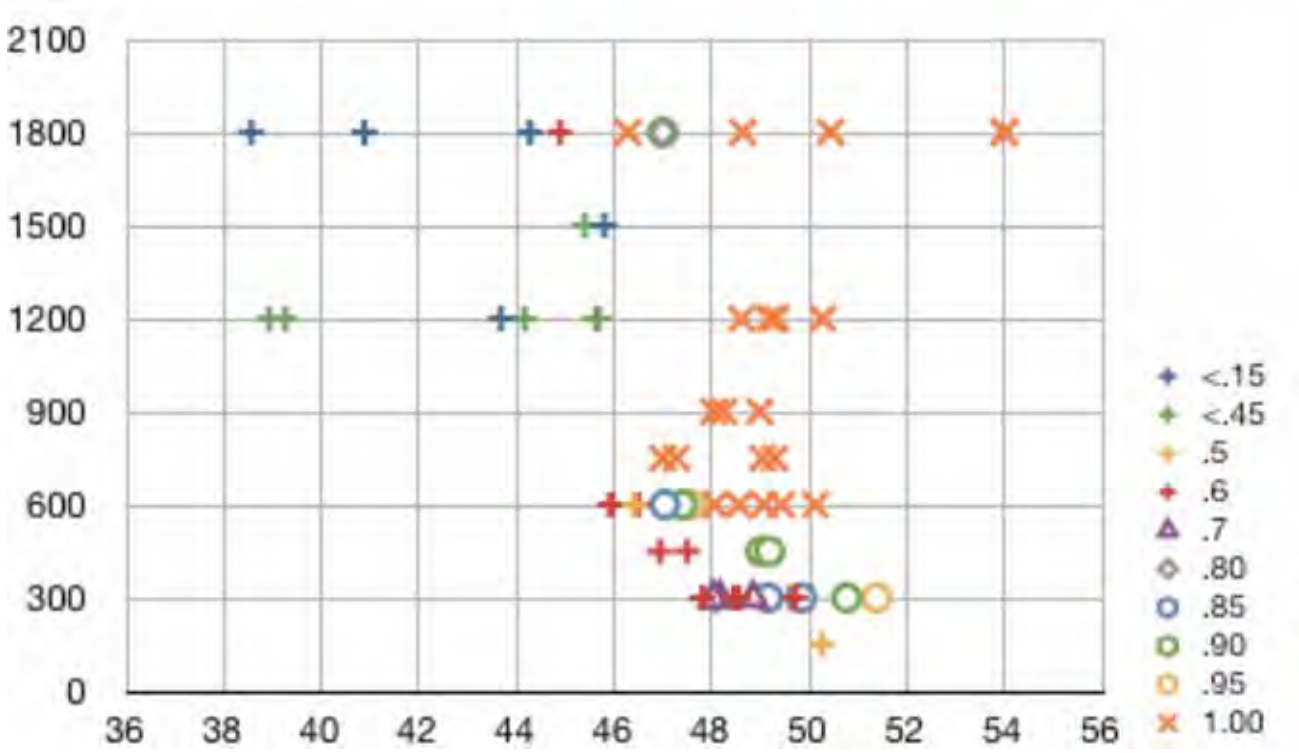
- Currently concentrating on hot air quarantine treatment for CBB in green bean
- Coffee Origin verification from green bean
- Small do-it-yourself or student built huller
- Drying

Developing hot air based method to kill CBB in green bean to satisfy quarantine of green bean

Mortality probability is a function of time and temperature.
Evaluate doses in time 5 to 35 minutes and temperature 35 to 55 C.
Literature says green beans can be held at 50°C for 2 hours before quality impact.
Recommend 50 C (122 F) for more than 30 minutes for probit 9 certainty of mortality.
Conducted experiments to establish time X temperature effect on cup quality with recirculated air at equilibrium moisture.
Designed and fabricated machine to treat one 100 lb bag of green bean
Fans push air through at about 1.5 cubic yards per second.
Tests on 1/3 bag lots was able to heat green beans to 122 F in less than 15 min.
Tested this machine in Kona.

Developing hot air based method to kill CBB in green bean to satisfy quarantine of green bean

Mortality probability is a function of time and temperature. Evaluated doses in time 5 to 35 minutes and temperature (95 to 131 F) 35 to 55 C.



Experiments established a probability for the detection of changes in cup profile when green coffee was held at a set temperature with recirculated air for a time period.
Detected by a random person from the general population cupping coffee untreated and from 4 temperature x time treatments.

Internal green bean temperature

Time at set temperature	122 F	167 F
15 min	20	10
20 min	2	0.09

% risk that a person cupping mistakenly thought there was a difference between the two cups when there was no difference.

NOTE: Experienced cuppers said hot air treated green coffee had better cup profile.

Designed and fabricated machine to treat one 100 lb bag of green bean

Takes one hour to treat bag (load bag, raise to temperature and hold, unload bag)
Draws 10 amps at 220 volts

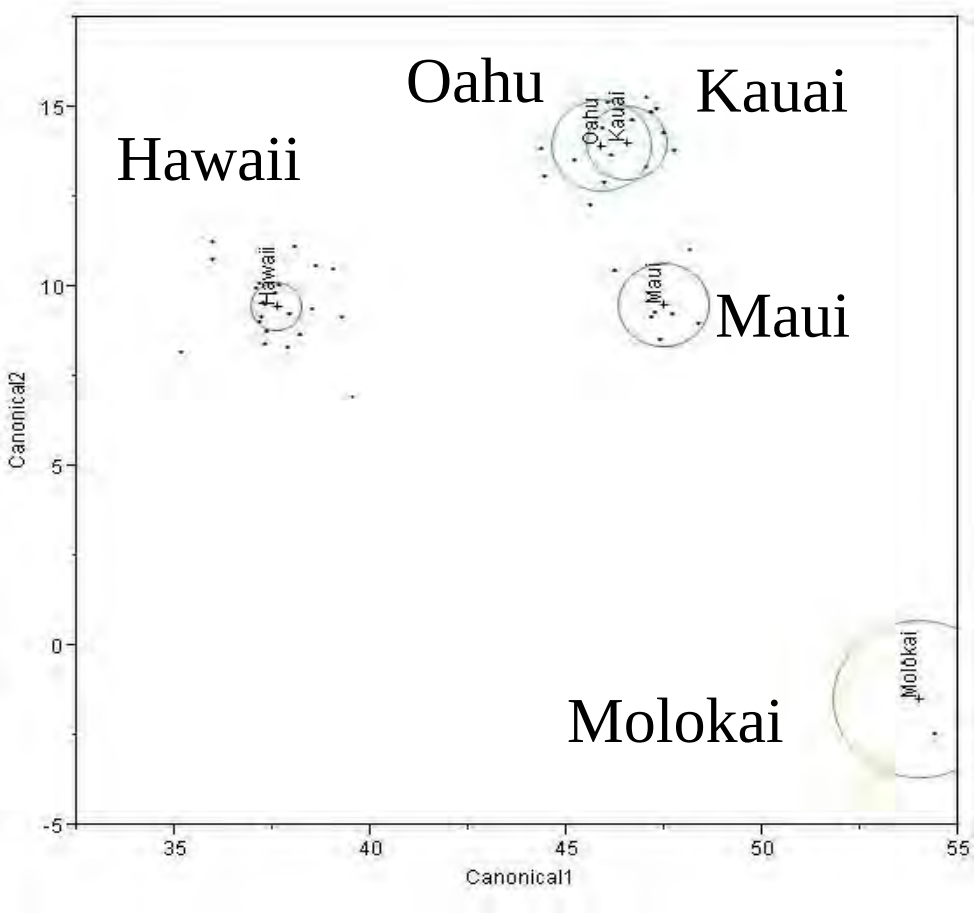
Operating costs for 1 bag or	100 lb green coffee
Labor	$15.00
Electricity	0.88
Total	$16 per bag

Coffee Origin Verification

Working with Portuguese lab. Good separation for one year samples using isotope ratios

Published article in
J of Agriculture and Food Chemistry 2011

Evaluation of 2012 samples is not yet complete. Will then have three seasons of data to compare.



Storing Parchment Before Milling

Observed a need for 11% moisture to assure CBB stops feeding.
Beetles taken from storage and kept at Kainaliu ambient temperatures
Beetles held at 20C (68F) do not multiple, feed, or spread to other beans.

Recommend drying to 10 to 11% moisture and reducing temperature to 60F (15C) to prevent damage in storage.

Small scale huller & winnower of wood or high density polyethylene

Huller will handle parchment, raisins (naturals) and cacao.

If DIY material costs $12 to 25 plus shop vacuum cleaner.

If made by CTAHR student club request $100 donation.

CBB Annual Survey Summary

A. Kawabata, E. Greco, Bittenbender

Second annual CBB survey was sent in mid September 2012 to coffee leaders requesting that they forward the survey link to growers. Survey was developed by Andrea Kawabata, Elsie Greco, and me.

Our goal is monitor the successful adoption of CBB IPM. Additional questions will appear as technology and the situation changes.

37 farmer/processors and 18 cherry farmers responded, this less than in 2011.

Please help us to increase the number of farmers and processors participating. The 2013 survey will start in August.

2012 CBB survey

Marketable Green Bean Recovery Ratio (MGBRR) for the 2011 crop as stated by farmers was 6.3 equal to 20% loss of green bean. Cherry buyers who sampled for CCB damage estimated 22% both for cherry loss and green bean loss.

50% farmers in 2012 felt CBB was decreasing on their farms; in 2011 only 13% thought it was decreasing.

2012 CBB survey : Sanitation

86% farmers said their pickers make an effort not to drop cherries during harvest; versus 62% in 2011.

Farmers (48%) report using closeable containers that prevent CBB escape during transport to the wet mill. This needs to increase.

After harvest in 2011 60% of farmers attempted to remove (strip and destroy) all coffee from their trees. 84% pledged to do so after the 2012 harvest.

2012 International Conference on Coffee Science stated the greatest predictor of future CBB damage on a farm is the number of infested cherries per tree after harvest. Also CBB infestation on farms or in feral coffee greater than ¼ mile away from a farm have little effect.

2012 CBB Survey : Trapping

Trap use increased to 76% of farms, compared to 53% in 2011.

Trapping is monitoring, so you know when to begin spraying Beauveria or EverGreen to knockdown swarms of CBB. Don’t expend time and money trapping instead of doing a better job stripping cherry and destroying it at the beginning of the pruning season or screening you pulping area.

2012 CBB survey : Spraying commercial Beauveria products

80% of farmers spray the fungus in 2012 similar to 2011.
10% spray year round, the majority begin in Feb to April.
In 2012 39% of farmers sprayed every 4 wk .
In 2012 38% of farmers spray less than 16 oz of *Beauveria* per acre, but *Beauveria* applications per acre per year are increasing due to more frequent spraying.

Volume averages 32 to 40 gal /acre.

2012 CBB Survey : Farmers quitting coffee due to CBB

58% of farmers reported that no one was quitting coffee, 19% knew of five, 10% knew of 10 quitting.

50% of farms border areas with feral or abandoned coffee.

2012 CBB Survey : Where do you get CBB information?

Important sources of information on CBB control are: other farmers (84%), the farmer's coffee organization website (68%), CTAHR workshops (66%), CTAHR website (63%) see ALERTS at www.ctahr.hawaii.edu, and their coffee organization workshops (60%).

The 2013 survey will be sent by August 2013, it will cover CBB damage levels in 2012, and cultural practices used in 2013.

A link to the survey will be sent to coffee leaders of organizations to forward to their members.

Chemical Desuckering of Stump Pruned Coffee

Too many verticals (suckers) are produced on stump pruned coffee, if number is not reduced by July of same year then self-shading will reduce yield in following year.

Hand desuckering is labor intensive and must be repeated during the pruning year.

Best chemical method Gramoxone is being discontinued.
Two substitutes are UAN (urea ammonium nitrate) and Aim (contact herbicide registered for coffee) are being tested.

UAN good leaf burn but not stem > 6 inches

Aim better stem burn

UAN and Aim will require multiple sprays scheduled before suckers > 6 inches.

Combination of hand desucker to select verticals with sprays to kill suckers below these verticals looks feasible.

Next spring we'll starting spraying before any verticals are > 6 inches.

Aim is registered for coffee sucker control, UAN is a liquid fertilizer concentrate.

Controlling CBB on Mechanized Farms

Mechanically harvested coffee farms in Brazil report using tractor -mounted blowers to blow dropped cherries to alleys.
Tractor mounted pick up devices are used to gather these cherries so they can be transported out of orchard and destroyed.
Several Brazilian coffee equipment companies sell this equipment.
Mechanized farms should consider evaluating this technology before CBB arrives on their island.

At 2012 Intl Coffee conference (ASIC) it was reported that stump pruning (Beaumont-Fukunaga) by blocks of rows (irrigation sections) instead of alternating rows greatly reduced CBB infestation in the first crop year after pruning. This can be practiced by any farm that stump prunes.

Questions or Comments ?