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Farm Case Study: La Divisa (smallholding)

Llano Grande District, El Aguila Municipality, Valle del Cauca Dept. COLOMBIA

Don Nevardo Restrepo, Farm Owner. Credit: P Lievens, PAN UK

Farm size: 1.46ha
Altitude: 1900m
CBB pressure in zone: Low
Crop system: Part-shaded, interspersed with plantain (some plots renewed). Soft fruit.
Coffee calendar: almost continuous flowerings, with two main harvest peaks
Farm owner: Don Nevardo Restrepo
Certifications: Utz, for several years
Farmer organisation: Member CafeNorte co-operative

Methods used for Coffee Berry Borer IPM (*most important in* **bold**)

Timely picking	✓	Regular grove renewal	–
Sanitary collections	✓	Shade regulation	–
Insecticides	–	**CBB % incidence monitoring**	✓
Biopesticides	–	CBB position assessment	✓
Trapping with methanol attractant	–	**Flowering register to forecast critical control periods**	✓
Other physical controls	✓	Other methods	–

***IPM effectiveness*:** Has not needed to spray insecticides for CBB control for 15 years, using only monitoring, cultural and physical controls. CBB levels very low (<<1%), aided by high altitude of farm.

Cultural Controls: Regular harvesting and sanitary removal of bored berries (green or ripe) every 15-20 days. Considers not too difficult or costly to do with family support and 1-2 workers. Benefit gained from good cultural controls is well worth paying for a few days' labour each time.

Physical Controls: Bored berries from sanitary pickings put in water to drown CBB and prevent breeding. At harvest time covers baskets at pulping station and field collection points with greased plastic, to prevent live CBB dispersing. Delivery funnel at pulper lined with plastic for easy washing and no cracks for CBB to hide in.

Trapping: Occasionally used a few methanol traps for monitoring and control but no real need as CBB levels very low now.

Monitoring and Decision-making: Uses flowering calendar to plan when plot monitoring and control needed 3 months after each episode. Samples 10 trees per small plot to monitor % incidence and position and find hotspots.

Recommendations: Very important to work as a team with family members and with neighbours all doing the same timely, cultural controls to reduce CBB infestation from one farm to another.
You must keep a careful eye out for when you need a sanitary picking- count your % bored berries!

Support organisation contacts: CafeNorte, www.cafenorte.com.co, Wilmer Andres Acevedo, Project Manager, email: liderdeproyectos@cafenorte.com.co, FNC extension service El Aguila branch, Henry Imbacuan, agronomist.

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Farm Case Study: La Divisa, Quindío (medium-sized farm)

Buenavista Municipality, Quindío Dept. COLOMBIA

Farm size: 15ha in coffee
Altitude: 1500m
CBB pressure in zone: Medium
Crop system: Part-shaded, with productive shade trees, interspersed with plantain. Regular plot renewal.
Coffee calendar: almost continuous flowerings, with two main harvest peaks.
Farm owner: Diofanor Ruiz L.
cafelapromesa@hotmail.com
Certifications: Rainforest, Utz and 4C for several years
Farmer organisation: Member of *Grupo Cordilleranos del Quindío* producer group

Don Diofanor Ruiz, Farm Owner. Credit: S Williamson, PAN UK

Methods used for Coffee Berry Borer IPM (*most important in* **bold**)

Timely picking	✓	Regular grove renewal	✓
Sanitary collections	✓	Shade regulation	-
Insecticides	-	**CBB % incidence monitoring**	✓
Biopesticides	✓	**CBB position assessment**	✓
Trapping with methanol attractant	-	Flowering register to forecast critical control periods	✓
Other physical controls	-	Other methods	-

***IPM effectiveness*:** With good grove management, very timely cultural controls, careful monitoring, and good background levels of *Beauveria* fungus, backed up by occasional hotspot applications of *Beauveria* products, achieves CBB levels well under 1%. Has not used endosulfan for 15 years and has eliminated insecticide use for all coffee pests in recent years by restoring ecological balance to entire farm.

Cultural Controls: Harvesting or sanitary picking every 15 days. Picking needs to be almost constant and very timely.

Renovates or replants trees every 7 years. Important for good IPM as younger and well-spaced trees allow you to do ReRe picking more efficiently in each plot.

Aim since buying farm was to change to a more ecological farm system. Mixed cropping of coffee with plantain, shade trees, minimal herbicide use, zero insecticide use, mulching and good ground cover has greatly reduced pest problems.

Monitoring and Decision-making: ***Incidence monitoring:*** Samples around 30 trees per ha, in zig-zag, x or z format, choosing one random branch per tree in middle/upper part of productive area, counting all berries to see which are bored and keeping any bored ones. *Borer position assessment:* If sampling reveals 5% or higher levels in a plot, will assess position in 100 bored berries, to see if >50% are in positions A/B (in flesh only) or C/D (inside bean so too late to spray).

Considers it not too difficult for farmers without high school education to sample, using simple materials produced by FNC extension service. Needs practice and support till familiar with procedure and depends more on farmer's commitment to coffee enterprise than level of education.

Recommendations: Timely action is essential. You need to keep a very careful eye on the behaviour of this pest- it can get into the beans in a very few days. You need to pick berries as soon as they ripen and make sure you leave no over-ripe or dried berries on trees.
Farms with older trees and where they don't take timely actions will have problems controlling CBB.

When you get 'good' or 'very good' flowering episodes, you'll need to sample those plots 90 days later to work out what you control actions you might need.

You should sample inside the plot and not at the edges, to avoid overestimating CBB levels (often higher on roadsides, pathways, near weighing station or where picking sacks left).

Other nearby *Grupo Cordillerano* farmers interviewed:

Jorge Alejandro Olivares, jorgealejandroolivares@hotmail.com **El Balcón farm** (25ha in coffee) uses: **Timely picking; Sanitary collections;** Insecticides; Biopesticides; Other physical controls; **CBB % incidence monitoring; CBB position assessment; Flowering register**. Picks weekly, with regular monitoring. When cultural controls alone are not sufficient, may supplement with very limited chemical (chlorpyrifos) application on hotspots (usually along pathways). Applies *Beauveria* to pulp pit and makes sure collection sacks tied close. Achieves very low CBB levels with this strategy. Monitors part of farm weekly to check % levels and assess borer position, if necessary. According to proportion of borers in positions A-D, will consult agronomist to either pick or use a permitted and FNC-recommended insecticide. Recommends using flowering register as one of the most important decision tools, so you know when to sample.

Fernando Corrales, Villa Marin farm (12ha, coffee and plantain) uses: **Timely picking; Sanitary collections;** CBB % incidence monitoring; Flowering register. Carries out very frequent picking and sanitary collection, every 10-12 days. Gains approximate idea of % infestation from berries collected. Only carries out full sampling 1-2 times per year, as CBB levels very low. Achieves 1-2% CBB levels without need to apply chemical or biological products. . Recommends that learning how to sample is not difficult, you just need to practice with good support from agronomist on where best to sample.

Support organisation contacts

National Coffeegrowers Federation (FNC) Buenavista Committee: Jorge Raul Gómez, extension agent, email: jorge.gomez@cafedecolombia.com.co

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Farm Case Study: La Lila Estate

La Selva District, Risaralda Municipality, Risaralda Dept. COLOMBIA

Doña Marlen Sánchez, Farm Internal Auditor. Credit: P Lievens, PAN UK

Farm size: 55ha
Altitude: 1400m
CBB pressure in zone: Medium-High
Crop system: Plantain & banana shaded along each plot border. Plot renewal every 5 years.
Coffee calendar: almost continuous flowerings, with two main harvest peaks.
Farm owner: Don Luis Albeiro Cardona O. agrovarsovia@yahoo.es
Certifications: Rainforest Alliance since 2006, Utz, 4C
Staff interviewed: Mrs Marlen Sanchez, Internal Auditor; vicmar.267@hotmail.com Mr Arlides Aricapa, CBB Supervisor
Farmer organisation: 1 of 5 estates belonging to Agrovarsovia Farms

Methods used for Coffee Berry Borer IPM (*most important in* **bold**)

Timely picking	✓	Regular grove renewal	✓
Sanitary collections	✓	Shade regulation	-
Insecticides	✓	**CBB % incidence monitoring**	✓
Biopesticides	✓	CBB position assessment	✓
Trapping with methanol attractant	-	Flowering register to forecast critical control periods	✓
Other physical controls	✓	Other methods	-

***IPM effectiveness*:** Combining cultural and biological controls, with very careful monitoring and planning, CBB levels are now below 2%. Estate has been reducing chlorpyrifos use, replacing it with *Beauveria* applications, and achieved zero chlorpyrifos use in 2013. Investing in this IPM programme, with a full time CBB control supervisor for the 5 estates, has delivered higher quality coffee with a 3-4% increase in price.

Cultural Controls: Regular, careful picking every 12-14 days per plot. Rigorous sanitary collections across all plots after major harvest periods is labour-intensive (1.5 person/days per ha) but worthwhile cost:benefit. Field supervisor for every 15-20 pickers checks and if >5% berries remain on trees or ground, plot is repicked. Regular plot renovation makes CBB control easier and cheaper..

Physical Controls: Use methanol traps in pulping station to trap any flying CBB + trap trees nearby. 2nd grade berries collected dried under sealed conditions to trap any CBB emerging.

Monitoring and Decision-making: Sample 30 trees per plot, counting full size green berries only on 10 high, 10medium + 10 low branches. Sample each plot every 15 days. Dssect each bored berry from sampled branches to record borer presence and position **(**3 hours to monitor 5ha plot). Consider over 2% in more than 2 out of 30 trees sampled per plot as a hotspot, for extra control action. Weekly task planning with farm manager, field supervisors and CBB supervisor also evaluate whether control actions successful.

Biopesticide Use: *Product used*: MicosPlag® (Orius) containing Beauveria + 2 other fungal agents, tank mixed with Trichoderma® (Orius) for disease control. *Dose rate*: 150-200g per ha in 300 litres for MicosPlag. *Frequency*: Usually 2 sprays per year in hotspots over 2% CBB. *Cost per ha application*: US$36.99 in product + US$35.51 in labour. More expensive than chlorpyrifos in immediate cost but many benefits, incl. longer-term control as *Beauveria* background levels increase, + lower costs in protecting worker health.

Recommendations: Most important control method is really good picking practices, no ripe, over-ripe or dried berries left on trees. Workers need training how to pick properly and do sanitary collection. Staff need to understand when and why things might be going wrong in a particular plot.

Neither insecticides nor biopesticides will deliver effective control if basics of good picking and post-harvest clean-up are not done well.

Well trained and dedicated staff, good organisation and good working relations, especially if aiming to reduce chemical use.

For more details, see Marlen Sanchez' presentation to *Growing Coffee without Endosulfan* project lesson-learning workshop, via project webpage http://www.4c-coffeeassociation.org/document-library/documents.html

Contacts

Marlen Sanchez, email: vicmar.267@hotmail.com; agrovarsovia@yahoo.es

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Farm Case Study: La Manzanares (smallholding)

La Cedalia District, El Aguila Municipality, Valle del Cauca Dept. COLOMBIA

Don Luis Aníbal Suárez, Farm Owner.
Credit: P Lievens, PAN UK

Farm size: 3.5ha
Altitude: 1750m
CBB pressure in zone: Low
Crop system: Part-shaded. Many coffee trees renewed with disease-resistant Castillo var. Livestock, poultry, fishpond, vegetables, citrus + other fruits.
Coffee calendar: almost continuous flowerings, with two main harvest peaks.
Farm owner: Don Luis Aníbal Suárez R
Certifications: Rainforest since 2007
Farmer organisation: Member of CafeNorte co-operative

Methods used for Coffee Berry Borer IPM (*most important in* **bold**)

Timely picking	✓	**Regular grove renewal**	✓
Sanitary collections	✓	Shade regulation	-
Insecticides	-	CBB % incidence monitoring	✓
Biopesticides	-	CBB position assessment	-
Trapping with methanol attractant	-	Flowering register to forecast critical control periods	✓
Other physical controls	-	Other methods	-

***IPM effectiveness*:** Has not needed to use insecticides for over 8 years, using only cultural and physical controls, with some monitoring**.** Even under heavy CBB attack in 2012, he managed to keep levels under control by picking every 15 days, even when he could not sell the beans collected. CBB levels very low (<<1%), aided by altitude of farm.

Cultural Controls: Very regular picking or sanitary removal of bored berries every 15 days (termed '*ReRe*'). Takes around 2 hours to collect 10-15kg of berries. Labour payment for collecting even unmarketable berries is necessary to end up with pest-free groves. Costs are recompensed by benefits from low CBB levels achieved and no health problems due to pesticide poisoning.

Renews part of groves (approx. 17%) each year- important for many reasons, including pest control. Much easier and quicker to harvest and do sanitary collections when trees are not too dense or tall.

Monitoring and Decision-making: His wife does all record-keeping, incl. flowering calendar and occasional CBB monitoring. Estimates around 1 hour to check incidence levels across their farm. With extension support, she recently did full incidence sampling and didn't find a single bored berry, proving how clean their groves are, compared with 10-12 years ago. At first considered all the record-keeping required by Rainforest very time consuming but it's part of the farm's commitment to the standard's values and his wife organises it very well.

Recommendations: 'ReRe' pickings are the best method, being prepared to do these very regularly. This way you're not killing all the wildlife or poisoning yourself with strong chemicals!

Good hygiene in the grove is essential. Important to train workers on how to do sanitary collections and check they are doing these properly.

Communal work sharing among 6-8 farm families (taking turns to work together on every farm) promoted by Neumann group is very effective for labour-intensive tasks like picking and planting.

Support organisation contacts

CafeNorte co-op www.cafenorte.com.co Wilmer Andres Acevedo, Projects Manager, email: liderdeproyectos@cafenorte.com.co National Coffeegrowers' Federation (FNC) extension service Valle de Cauca (El Aguila branch), Henry Imbacuan, agronomist, email: henry.imbacuan@cafedecolombia.com.co

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Case Study of Reduced Endosulfan Use: Miramar Estate

El Limon Canton, Santa Tecla Municipality, La Libertad Dept. EL SALVADOR

Farm size: 43ha
Altitude: 1100m
CBB pressure in zone: Medium-High
Crop system: Mainly full sun, regular plot renewal.
Coffee calendar: Defined main flowering, one harvest period per year.
Farm owner: Miramar S.A. S.V.
Certifications: None
Farmer organisation: None. Supplies coffee to COEX exporters.

Don Alfonso Argueta, Farm Manager. Credit: P Lievens, PAN UK

Methods used for Coffee Berry Borer IPM (*most important in* **bold**)

Timely picking	-	Regular grove renewal	-
Sanitary collections	✓	Shade regulation	-
Insecticides	✓	CBB % incidence monitoring	✓
Biopesticides	-	CBB position assessment	✓
Trapping with methanol attractant	✓	Flowering register to forecast critical control periods	-
Other physical controls	-	Other methods	✓

***IPM effectiveness*:**

Cultural Controls: Don't remove early mature berries because they get very uniform ripening so it's not really needed on this estate. Allow local people to collect pepena berries after harvest, leaving the groves cleaned up and reducing CBB breeding in next season.

Trapping: Make home-made traps from drinks bottles each year and place these after harvest at 28 traps per ha equivalent, using methanol attractant sold by COEX. Estimates 2 weeks' work for 2 people to make, hang and maintain traps for their estate. Started included trapping in dry season as CBB incidence is increasing in last 3-4 years.

Monitoring and Decision-making: Annual plot sampling around 90 days after flowering, of 5 trees per ha, counting 20 berries per tree, and assessing borer position (1= just entering the flesh; 2= starting galleries in bean: 3 = larvae inside the bean- this is serious damage). Spraying needed if CBB incidence exceeds 5%. At 3-4% you need to wait and see if attack worsens. Best to apply endosulfan when borers are in position 1.

Biopesticide Use: Does not use because he considers that fungus only works well in groves already with high CBB levels and to prevent infestations spreading. Prefers 'total control' provided by endosulfan. Also, *Beauveria* spores will be killed by fungicide spraying.

Insecticide Use: Regular endosulfan use for many years. Used to apply at full dose but has been able to reduce dose after introducing methanol trapping method on farm since 2011. *Dose:* Endosulfan at half dose of 710ml per ha. Adds 200cc of sticking agent per barrel, to protect against rainwash. One application during Jul-Aug period is sufficient. This year applied preventative spray in Jun in plots with early-maturing variety, which is more susceptible to CBB.

Starts spraying on most infested plots according to sampling around 90 DAF, and least affected plots done last. Takes 4.26 person days to spray 1 ha. *Cost:* at least US$26.96 per ha (US$6.39 in product + US$20.57 in labour) + cost for sticker. Finds endosulfan application is considerably more expensive than using traps.

Other methods: Released parasitic wasps some years ago in collaboration with researchers but when you use endosulfan, they will be killed. Would like to reduce use of chemicals although this means learning to live with the pest to some extent. *Beauveria* and wasps are useful and can give half reasonable level of control, but will not eliminate the problem.

Recommendations: Best to spray when borer is just entering flesh, as it's harder to kill once inside the bean.

Support organisation contacts

COEX (Comercial Exportadora S.A.de C.V.) www.grupocoex.com René Fontan, Head Agronomist, email: renefontan@coex.com.sv See also the detailed cost comparison of trapping versus endosulfan use on COEX own estates, presented by René Fontan at the *Growing Coffee without Endosulfan* lesson-learning workshop, via the project webpage
http://www.4c-coffeeassociation.org/uploads/media/5_CoEx.pdf

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Farm Case Study: Santo Domingo (smallholding)

Las Mesas Canton, Chinameca Municipality, San Miguel Dept. EL SALVADOR

Farm size: 2.1ha
Altitude: 700m
CBB pressure in zone: High
Crop system: Shaded, traditional Bourbon variety (some trees renewed).
Coffee calendar: Defined main flowering, one harvest period per year.
Farm owner: Antonio Gómez V.
Certifications: Organic since 1998
Farmer organisation: Member of Jucuapense organic producer co-op.

Don Antonio Gómez, Farm Owner. Credit: P Lievens, PAN UK

Methods used for Coffee Berry Borer IPM (*most important in* **bold**)

Timely picking	✓	Regular grove renewal	-
Sanitary collections	✓	Shade regulation	-
Insecticides	-	CBB % incidence monitoring	-
Biopesticides	✓	CBB position assessment	-
Trapping with methanol attractant	-	Flowering register to forecast critical control periods	-
Other physical controls	-	Other methods	✓

***IPM effectiveness*:** With 1-2 Beauveria applications each season and cultural controls he has CBB reasonably well controlled although incidence has risen this year throughout zone. Current levels are not too bad, for a zone where CBB can reach 30% if not controlled at all, and where some of his neighbours' plots are almost abandoned, causing CBB proliferation.

Cultural Controls: Two *graniteo* rounds, timed when early berries are ripening. *Pepena* clean-up after harvest. Doesn't see *graniteo* labour as costly, just 1 -2 person/days for his farm, i.e. approx. 0.5-0.95 days per ha. Allows local people to collect *pepena* berries so he has no labour costs for that.

Physical controls: Buries *graniteo* berries as they rot very quickly in hot, humid conditions here.

Trapping: Would like to use but cannot obtain attractant locally (PROCAFE centre is over 3 hours drive away).

Monitoring and Decision-making: Doesn't do systematic sampling but regular observation in groves to see how much CBB and where it's heaviest.

Biopesticide Use: Makes two general applications per year around 1 month apart in mid-Jun and mid-Jul [around 90-120 days after main flowering]. *Product used*: 3B brand semi-commercial spores on rice packs (produced by PROCAFE research institute). *Dose rate*: 450g per 200 litre barrel, using 1.42-2.13 barrels per ha. *Cost per ha application*: US$9.23-13.84 product + 2.84 days labour.

No special measures taken to protect spores from sunlight but applies it as soon as he obtains packs from co-op, adding molasses to help it stick. After washing spores off rice into solution, keeps rice grains in a cool place to encourage further spore formation, then spreads these in hotspots later.

Has applied *Beauveria* for 6 years but initially just scattered rice grains in groves, when pest pressure was low. More recently applies with knapsack sprayer. Generally finds it effective and usually notices some *Beauveria* growing one week or more after each application. Hard to control CBB totally in this zone and an application may be too late to kill some borers if already entering the bean.

Insecticide Use: Not used since converting to organic.

Other methods: In 2009 was given wasps to release by PROCAFE and supposes some are still surviving in groves because he occasionally sees wasps when opening berries. He would have liked training in how to do mass rearing, as done in other zones, to increase wasp numbers.

Other nearby farm visited in same organic co-op:

Claudia Martinez Ruiz & Maria Josefina Ruiz, El Cerrito farm (3.2ha smallholding): Use **Sanitary collections; Biopesticides.** Remove bored early ripening berries regularly before harvest. Apply 3B semi-commercial rice + spores Beauveria product of PROCAFE, supplied by their organic producer co-op. Also receive technical advice from FUNDE NGO. Never used insecticides.

Support organisation contacts

FUNDE (National Foundation for Development) www.funde.org: Agronomist and organic specialist, Sebastian Cedillos, email: sebastiancedillos@yahoo.es; Project Coordinator Guillermo Vásquez, email: guillermo.vasquez@funde.org

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Farm Case Study: La Herencia (medium-sized farm)

Buena Vista District, San Juan del Rio Coco Municipality, Madriz Dept. NICARAGUA

Don David Pérez, Farm Owner.
Credit: P Lievens, PAN UK

Farm size: 11.2ha
Altitude: 1100m
CBB pressure in zone: Low
Crop system: Shaded, traditional, with newer varieties replanted.
Coffee calendar: defined main flowering, with one harvest period per year
Farm owner: David Pérez
Certifications: Rainforest since 2007
Farmer organisation: Member of 20 de abril services co-op and CONFOP marketing co-op

Methods used for Coffee Berry Borer IPM (*most important in* **bold**)

Timely picking	✓	Regular grove renewal	-
Sanitary collections	✓	Shade regulation	-
Insecticides	-	CBB % incidence monitoring	-
Biopesticides	-	CBB position assessment	-
Trapping with methanol attractant	-	Flowering register to forecast critical control periods	-
Other physical controls	-	Other methods	-

***IPM effectiveness*:** With good cultural controls alone, achieves coffee with 2-2.5%, bored beans in a zone where CBB levels can rise to >5% if not controlled. He has managed to keep CBB below 2.5% for 11 years using this system.

Cultural Controls: 2 rounds pre-harvest selective removal of bored early ripe berries (*graniteo)* Jul-Sep then a thorough sanitary control (*pepena*) of fallen berries and any left on trees during 2-3 months after harvest. *Pepena* is costly but necessary, using 15-18 people per day for several days. *Graniteo* is quicker and more economical, taking 0.28-0.42 person day/ha, and US$3.67 per ha total in labour. *Graniteo* requires careful work, he may offer workers a slightly higher daily rate, to motivate them to do the job well. Aim is to prevent CBB reproducing in these early ripening berries and damaging the future harvest.

To make sanitary control easier, does manual slashing of weeds just beforehand, leaving the cut material for a couple of days to rot or dry up and then people can spot the fallen berries more easily.

In 2012 due to very low coffee prices and difficult economic situation (made worse by severe coffee rust attack in many farms) allowed local people to collect fallen and remaining berries on branches. They can then sell these or use them for home consumption. He benefits from getting CBB removed from his groves and poorer people locally benefited as they were desperate to earn some income.

In first *graniteo* pass, each worker probably only collects 2.3-4.5kg berries, in 2nd pass, probably 6.8-9.0kg as more berries are maturing.

Physical Controls: Berries from *graniteo* put in boiling water to kill CBB. *Pepena* beans can be used for home consumption.

Monitoring and Decision-making: -Checks plots regularly for any disease or pest problems or trees in poor health. Qualitative assessment of CBB hotspots by noting where bored berries are prematurely ripening.

Insecticide Use: Never used.

Recommendations: Don't use endosulfan, it's too harmful. Farm owners should pay a little more money to do good cultural controls than risk affecting their workers' health.

Cultural controls may not be 100% effective but if done well you can achieve good control. He likes to monitor plots and identify hotspots himself.

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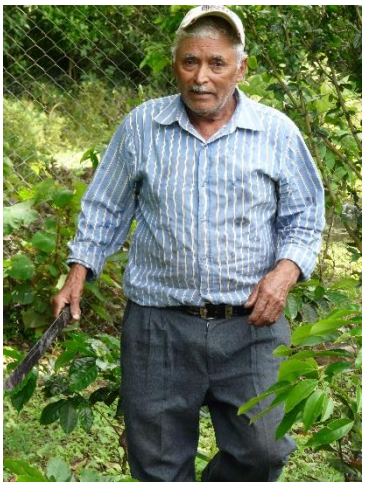
Farm case study: La Ilusión (smallholding)

El Sontule District, Oro Verde Municipality, Estelí Dept. NICARAGUA

Farm size: 2.1ha in coffee
Altitude: 1236m
CBB pressure in zone: Low
Crop system: Shaded, traditional (some trees renewed). Kitchen garden + livestock.
Coffee calendar: defined main flowering, with one harvest period per year.
Farm owner: Rogelio Villareyna
Certifications: Organic & Fairtrade for over 10 years
Farmer organisation: Member *Vicente Talavera* co-op & regional PRODECOOP



Don Rogelio Villareyna, Farm Owner. Credit: P Lievens, PAN UK

Methods used for Coffee Berry Borer IPM (*most important in* **bold**)

Timely picking	✓	Regular grove renewal	-
Sanitary collections	✓	Shade regulation	✓
Insecticides	-	CBB % incidence monitoring	-
Biopesticides	✓	CBB position assessment	-
Trapping with methanol attractant	-	Flowering register to forecast critical control periods	-
Other physical controls	-	Other methods	-

***IPM effectiveness*:** With careful cultural controls, he doesn't get much CBB problem in this zone, except in one heavy attack season 5 years ago. He managed to prevent too much damage in that attack by applying *Beauveria*.

Cultural Controls: In this zone, with a short, late harvest period, one selective *graniteo* picking, about 1 month before harvest, serves as both a sanitary control and an initial picking. Labour required for *graniteo* depends on berry load in a specific season. If it's fairly high load, you need 3 persons for 5 days to do this collection in his 2.1ha plots, i.e. approx. 7 days per ha. Pays this by day, not volume, because workers will collect only 4.5-7 kg each day, it's mainly a cleaning operation but he usually is able to sell part of this coffee. He often allows locals and workers to take berries from the last harvesting round as part of his clean-up.

Does post-harvest *pepena* collection with is 2 regular workers at same time as post-harvest bush pruning, collecting any berries they notice on trees and any left on ground. It's part of starting the new coffee cycle, coppicing some trees, clearing out branches and other trash. Annual pruning of coffee trees and shade trees is important part of good grove management, especially for organic farmers.

Physical Controls: If any berries in very first harvest picking (*graniteo*) are bored at all, puts all berries in boiling water to kill CBB. Will carefully select beans delivered to mill as they reject coffee if >7% defects.

Monitoring and Decision-making: Observes plots regularly and checks very carefully first harvest round berries to see if any are bored.

Biopesticide Use: Occasional applications of *Beauveria* some years ago when CBB pressure was higher. Used Mirabiol brand semi-commercial rice + spores packs from nearby Miraflor co-op. Now has good natural levels of fungus in his shaded groves.

Insecticide Use: Not used since converting to organic.

Recommendations: Important to take timely, preventative action against CBB. You need to be doing preventative controls -once coffee is very badly infested with CBB there's not much you can do for that harvest.

In the last harvest pass you need to make sure no berries left on trees and definitely not on ground. Those berries left on the ground will become serious CBB breeding sites.

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Farm Case Study: La Naranja (medium-sized farm)

Buena Vista District, San Juan del Rio Coco Municipality, Madriz Dept. NICARAGUA

Don Ulíses Pérez, Farm Owner.
Credit: P Lievens, PAN UK

Farm size: 21ha
Altitude: 980-1100m
CBB pressure in zone: Low
Crop system: Shaded, traditional, with newer varieties replanted + pasture.
Coffee calendar: defined main flowering, with one harvest period per year.
Farm owner: Ulíses Pérez
Certifications: Rainforest since 2007, formerly organic.
Farmer organisation Member of *20 de abril* services co-op and CONFOP marketing co-op

Methods used for Coffee Berry Borer IPM (*most important in* **bold**)

Timely picking	✓	Regular grove renewal	-
Sanitary collections	✓	Shade regulation	-
Insecticides	-	CBB % incidence monitoring	-
Biopesticides	-	CBB position assessment	-
Trapping with methanol attractant	-	Flowering register to forecast critical control periods	-
Other physical controls	✓	Other methods	-

***IPM effectiveness*:** Cultural controls work well and he has not needed to use other controls, e.g. methanol trapping. His farm has a very low level of CBB damage (around 2%) using these controls and has not suffered bean rejections for quality defects.

Cultural Controls: 2 rounds *graniteo* to remove early ripening berries containing CBB, in Jul-Aug and again in Oct. *Pepena* collection in Jan-Feb after harvest, mainly to remove berries left on ground. 2 workers can easily pick *graniteo* berries in 0.7ha, i.e**.** 2.85 person/days per ha. For his 21ha farm, for two *graniteo* rounds, approx. US$24 per ha labour cost. This work is fairly quick as only a few trees will be showing ripe berries. *Pepena* clean-up needs approx.10-12 person days per ha but he 'gives away' *pepena* coffee to his workers or local people, i.e. does not have to pay the labour costs.

If there are a lot of early ripening berries in a particular season, due to significant early flowering, he may pay *graniteo* by volume.

Pepena clean-up very important to prevent surviving CBB infesting developing berries of the next season. It benefits local people to collect *pepena* because they can sell the unprocessed berries for a reasonable income, especially if their family members help out. Some farmers are too mean to do this but they've not done the sums to see that paying for this labour is more expensive.

Physical Controls: Early ripening berries picked for *graniteo* very likely to be bored so put in boiling water to kill pest. Also separates bored floating beans after pulping and puts them in boiling water to kill any live CBB.

Monitoring and Decision-making: No quantitative monitoring but has approximate idea of parts of plots where CBB tends to be bad.

Insecticide Use: Never used.

Recommendations: Stop using endosulfan, it can be lethal and it contaminates the environment! Do cultural controls instead. *Graniteo* picking is the first task in CBB management, important to remove borer breeding populations.

Best to keep an eye on people collecting *pepena* to make sure they're doing it well and collecting from the entire plot, but you don't need to supervise them all day long.

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Farm Case Study: Linda Vista (small medium-sized)

Los Cerrones 2 District, Jinotega Municipality, Jinotega Dept. NICARAGUA

Farm size: 8.4ha under coffee
Altitude: 900m
CBB pressure in zone: Medium
Crop system: Mainly shaded, Caturra Estrella disease-resistant variety in recent replantings. Plus pasture.
Coffee calendar: defined main flowering, with one harvest period per year.
Farm owner: Mr Henry Zelaya A.
Certifications: Fairtrade
Farmer organisation: Local co-op affiliated to SOPPEXCCA marketing & services co-op

Don Henry Zelaya, Farm Owner.
Credit: S Williamson, PAN UK

Methods used for Coffee Berry Borer IPM (*most important in* **bold**)

Timely picking	✓	Regular grove renewal	-
Sanitary collections	✓	Shade regulation	✓
Insecticides	-	CBB % incidence monitoring	-
Biopesticides	-	CBB position assessment	-
Trapping with methanol attractant	✓	Flowering register to forecast critical control periods	-
Other physical controls	✓	Hotspot identification	✓

***IPM effectiveness*:** CBB now under good control on his farm, using good cultural controls and traps. Using traps has helped enormously in achieving better CBB control and he' not been penalised for borer damage since then. Infestation levels were quite severe before he introduced trapping, even when spraying endosulfan and doing cultural controls.

Cultural Controls: 2 *graniteo* rounds, according to when berries ripen from early flowerings, removing all mature berries and any bored green ones. Estimates each *graniteo* round takes 4 person days for his 8.4ha farm, i.e. around 2 days per ha. Considers this cost a beneficial investment as costs are very low compared with damage CBB can cause. Currently prefers to pays workers daily rate for *pepena* clean-up after harvest than let locals take berries, because people won't put much time in with low coffee price. Manual weeding beforehand to make post-harvest sanitation easier.

Physical Controls: Boils then buries *graniteo* berries to prevent CBB spreading. Most of them are useless -you can go through them after drying and pick a few out to sell, but it's very little.

Trapping: Home-made using empty 1.5-2 litre bottles, with 3 windows cut. *Density:* now placing traps at 28.4 per ha (higher density than 22.7 recommended). *Positioning:* across entire farm but places traps closer in hotspots and next to neighbours' poorly managed plots. *Timing:* end February-beginning March, in dry season. *Cost:* Pays US$0.04 per empty bottle. Methanol and syringes

obtained on credit from co-op [at US$0.21 per trap worth]. For his farm and density used, costs US$6.86 per ha. *Maintenance:* checks every 15 days during dry season and refills if necessary (usually 2 or 3 times). Majority of traps and syringes can be used the following year if you look after them carefully. Takes one person 3 days to make and place 200-300 traps, i.e. around 0.4 days per ha.

Considers results excellent and trapping much cheaper and better than spraying chemicals (as he used to do until three years ago). Endosulfan was not always effective. Traps are easy to use and risk-free, unlike chemical products. With the local Agriculture Ministry office, he's talked at meetings to convince more farmers to change to trapping.

Monitoring and Decision-making: Does rough assessment to identify hotspots and put up more traps in those areas, usually shady parts. Now takes careful note of when erratic flowering takes place, as the climate is changing and you can no longer predict flowering or calendar schedule graniteo collections.

Insecticide Use: Not used since trapping introduced by co-op in 2012.

Recommendations: Important to monitor each plot and keep checking to see when the first berries are ripening and borer begins to enter these, so you know when to collect them.

If a farmers lets this pest do what it likes, without spending on controls, he risks losing the harvest. You need to supervise workers well so they'll carry out good work during *graniteo* picking.

Traps are better and more reliable than spraying endosulfan because you don't have the problem of trying to time the insecticide application and the risk of wasted effort if CBB is already inside the bean. As long as the traps are in place in the dry season, they will start catching CBB before they attack the new berries.

Support organisation contacts

SOPPEXCCA co-operative: Erik Antonio Morales, technical and training department, email: erk2676@gmail.com; co-op extension agent for Jinotega municipality, Marlon López, email: marlonantoniolopezrivera@yahoo.es

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Farm Case Study: Los Planes (medium-sized farm)

Miraflor District, Oro Verde Municipality, Estelí Dept. NICARAGUA

Farm size: 7ha in coffee
Altitude: 1250m
CBB pressure in zone: Low
Crop system: Part-shaded (some plots renewed). Also vegetables + cattle.
Coffee calendar: defined main flowering, with one harvest period per year.
Farm owner: Rodolfo Lago
Certifications: Fairtrade since 1997
Farmer organisation: Member of regional PRODECOOP

Don Rodolfo Lago, Farm Owner. Credit: P Lievens, PAN UK

Methods used for Coffee Berry Borer IPM (*most important in* **bold**)

Timely picking	✓	Regular grove renewal	-
Sanitary collections	✓	**Shade regulation**	✓
Insecticides	-	CBB % incidence monitoring	-
Biopesticides	-	CBB position assessment	-
Trapping with methanol attractant	-	Flowering register to forecast critical control periods	-
Other physical controls	-	Other methods	-

***IPM effectiveness*:** Has never used insecticides for CBB control, main control tactic is *pepena* after harvest and good picking practices, plus some *graniteo*. Only once received price penalty for bored beans in 2004, an outbreak year when some of his beans reached 7-8% levels. Currently at low level.

Cultural Controls: 1-2 rounds *graniteo* selective removal before harvest + thorough *pepena* clean-up after harvest. He lets his workers take all the *pepena* berries to sell or use. Estimates graniteo takes 7 person/days per ha. Rainy weather before harvest can cause many berries to fall, so you need to collect these otherwise you generating CBB problems. Checks when weeding in May-Jun that no berries are still there. To help *pepena* collection and other tasks, 2 manual weedings in May-Jun, then Nov.

Shade regulation: At this altitude and frequent cloud cover it's important not to have too much shade as this is where CBB thrives. He replaced very large trees and those that lose all their leaves in the dry season with more manageable species where you can easily prune back a few branches, without damaging the coffee bushes. Considers CBB worse in traditional groves and on farms that don't regulate shade. It can be problematic if neighbours don't maintain plots properly.

Monitoring and Decision-making: Checks how much borer damage there is in each batch of harvested beans and check in plots. Knows hotspot locations, usually along borders with neighbours.

Insecticide Use: Never used

Recommendations: Take care to pick the first *graniteo* round before bored berries start to split or fall or you will get problems of CBB reproducing on the ground.

You need to keep an eye on harvest workers to avoid anyone deliberately dropping berries to collect later in *pepena*. You may need to win over people by offering them e.g. 18-20kg worth of green berries in *pepena* to sell. It's about supervising carefully but also giving people respect and benefits.

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Farm Case Study: San Jose (smallholding)

Los Cerrones 3 District, Jinotega Municipality, Jinotega Dept. NICARAGUA

Farm size: 5.6ha
Altitude: 880m
CBB pressure in zone: Medium
Crop system: Part-shaded Caturra-Catimor variety, intercropped with plantain. Some trees renewed when resources permit.
Coffee calendar: defined main flowering, with one harvest period per year.
Farm owner: Mrs Francisca Gutierrez
Certifications: Fairtrade since 2006
Farmer organisation: Member of local UCASOPE co-op affiliated to SOPPEXCCA marketing & services cooperative.

Doña Francisca Gutierrez, Farm Owner. Credit: S Williamson, PAN UK

Methods used for Coffee Berry Borer IPM (*most important in* **bold**)

Timely picking	-	Regular grove renewal	-
Sanitary collections	✓	Shade regulation	-
Insecticides	-	CBB % incidence monitoring	-
Biopesticides	✓	CBB position assessment	-
Trapping with methanol attractant	✓	Flowering register to forecast critical control periods	-
Other physical controls	-	Other methods	-

***IPM effectiveness*:** Using cultural controls, combined with traps since 2012, she is now satisfied with CBB controls and levels are fairly low on her farm.

Cultural Controls: Does one *graniteo* round to remove early ripening berries, estimating 10 person days for her farm, i.e. 1.8 days/ha, costing around US$60. This takes time to do properly, to make sure no ripening berries left to cause pest problems for the main harvest. Considers this cost quite a lot of money so she dries these berries to sell any undamaged or slightly damaged beans. She pays workers to collect post-harvest *pepena* remaining berries, at daily rate, if it's few berries or by volume if there is a lot to pick up.

Trapping: Home-made traps from empty 1-2 litre drink bottles, with methanol attractant supplied in syringes by SOPPEXCCA field agents. Adds soap or detergent to water. *Density:* 22.7 traps per ha, placed across whole farm**.** *Timing:* May-June when coffee starts to flower and new berries begin to form. *Cost:* US$4.73 per ha, for methanol + syringes as diffusers, supplied on credit by co-op. Zero cost for using empty drinks bottles, collected or saved. Checks traps every 3 weeks to clean out and refill methanol and water. Finds it quick and easy to make approx. 100 traps for her needs. Good results so far. She first used traps in 2012 and had fewer bored berries in her coffee harvest in 2012

and seems little CBB incidence this season after trapping. Makes new traps each year as some get damaged, especially when plantains are harvested.

Monitoring and Decision-making: Regularly visits plots to check for problems in general. CBB attack can be observed where berries are ripening early. Checking damage levels in early pickings will also show where problem areas are**.**

Biopesticide Use: Applied *Beauveria* for first time in June 2013, encouraged by SOPPEXCA co-op technicians and following their instructions not to apply any other product at the same time asit could affect fungus. Sprayed only in certain parts where CBB problems highest, according to visual inspection to find early ripening and bored berries. Too early to judge effectiveness. *Product used*: Mirabiol semi-commercial rice with spores, from UCA Miraflor, supplied on credit by her co-op. *Dose rate*: equivalent to 886g rice per ha. *Cost per ha application*: US$11.36 per ha. Doesn't consider price as costly.

Insecticide Use: Never used due to cash constraints.

Recommendations: It's no use being an absent owner- you need to keep an eye on the workers and she sometimes picks *graniteo* with them too. There are good, responsible workers who do their job well but you always need to check on them.

Trapping is cheap, very affordable for poor farmers like herself and you easily can make them yourself, collecting empty bottles. Recommends farmers to start with trapping as a simple, cheap method to stop using endosulfan and to ask for training. Larger farmers are starting to use the method too.

Support organisation contacts

SOPPEXCCA co-operative: Erik Antonio Morales, technical and training department, email: erk2676@gmail.com; co-op extension agent for Jinotega municipality, Marlon López, email: marlonantoniolopezrivera@yahoo.es

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Farm Case Study: Gracias a Dios (medium-sized farm)

Zone 6 District, San Juan del Rio Coco Municipality, Madriz Dept. NICARAGUA

Farm size: 7.7 ha
Altitude: 870m
CBB pressure in zone: Low-Medium
Crop system: Shaded, traditional, with newer varieties replanted + beehives
Coffee calendar: defined main flowering, with one harvest period per year
Farm owner: Eriberto Altamirano
Certifications: Organic and Fairtrade since 2004
Farmer organisations: Member of *17 de octubre* services co-op and regional PRODECOOP

Don Eriberto Altamirano, Farm Owner. Credit: P Lievens, PAN UK

Methods used for Coffee Berry Borer IPM (*most important in* **bold**)

Timely picking	-	Regular grove renewal	-
Sanitary collections	✓	Shade regulation	-
Insecticides	-	CBB % incidence monitoring	-
Biopesticides	✓	CBB position assessment	-
Trapping with methanol attractant	-	Flowering register to forecast critical control periods	-
Other physical controls	-	Other methods	-

***IPM effectiveness*:** Cultural controls, along with two applications of *Beauveria* per season, keep CBB levels below 3% on his farm. On poorly managed farms, levels can easily reach 5%.
Cultural Controls: 2 rounds of *graniteo* pre-harvest sanitary pickings of early ripening berries. Estimates *graniteo* needs 5.6-7.0 person/days per ha, totalling around US$60 per ha. He usually allows locals to collect *pepena*, unless there is a lot of coffee remaining on the floor. Estimates around 14 days per ha to collect *pepena* well, paid on a daily rate.

Biopesticides: Most seasons makes at least one *Beauveria* application, using Mirabiol brand semi-commercial rice + spores packs from lab belonging to Miraflor Producer Co-op. Sometimes makes 2nd application near harvest. Uses higher dose than recommended 3 packs of 310g per 0.7ha (compared to 2 pack). At July 2013 price equivalent to approx. US$17 per ha in product. Has to pay workers 25% more daily rate to spray late in the afternoon, after the end of the usual work day but considers it better to keep fungus away from strong sunlight.

Monitoring and Decision-making: Rough assessment of hotspots from observations in plots.

Insecticide Use: Tried calcium sulphate [organic permitted] once in very hot season with serious CBB pressure. Seemed to have a repellent effect on pest.