



Netting for Physical IPM of Coconut Rhinoceros Beetle

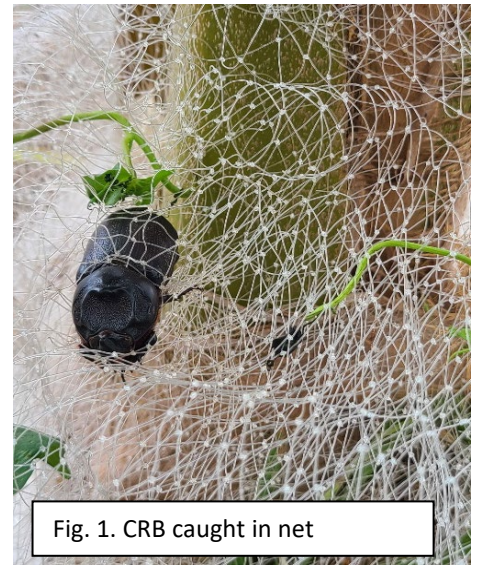
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BACKGROUND

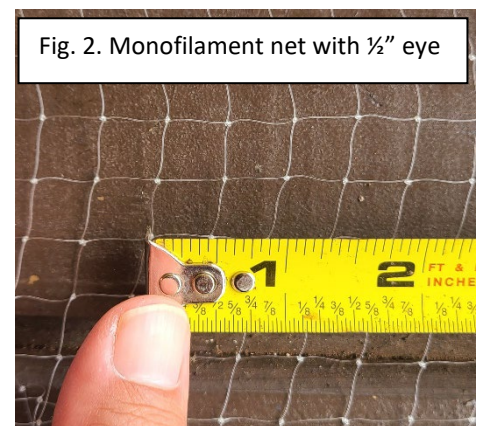
Coconut Rhinoceros Beetle (CRB) was first detected on O'ahu in 2013 but since then has become a major pest of coconut and palm species. CRB eat the meristem (e.g., growing tissue) located in the middle of the palm crown, causing either leaf damage or possibly complete crown death. Management of CRB can take an integrated pest management (IPM) approach of various preventative, cultural, physical, biological, or chemical practices. Management focuses either on the palm tree to target adults (e.g, insecticide sprays), or on mulch piles that serve as breeding sites for CRB larvae (e.g., mulch avoidance, heat treatment). However, practices to control CRB can be limited for certain growers who do not use synthetic insecticides or need to use mulch for water management.

Netting is a physical IPM practice that can trap and kill CRB adults on trees and mulch piles (Fig. 1). Below are information and tips on utilizing netting as one management practice to control CRB.



NET TYPE, SIZE

Netting has been used in other locations such as Guam and India to catch or deter CRB (Moore et al. 2014, Sujithra et al. 2022). Monofilament netting is preferred for its flexibility, strength, and thinness to catch CRB. Netting of ~0.33mm thickness with ½" x ½" square or side measurements effectively catch CRB with minimal wrapping (Fig. 2). Larger nets (e.g., ¾" or 1" side measurements) can also be effective but require multiple wrappings to overlap net openings. Although not an exhaustive list nor an endorsement, Lee Fisher Fishing Supply or Memphis Net & Twine are two example companies where monofilament netting of this size can be purchased.





NETTING TREES

Netting coconut and palm trees can prevent CRB from damaging the plant, and is most feasible for low-bearing trees that can be easily managed. Here are some tips to net trees effectively.

- Use the appropriate **type of net and size** described in the previous section (monofilament, ½" square eye).
- **Trim off** old branches or flowering parts that may tangle net during the wrapping process
- **Utilize a technique** that fully covers entry points and prime feeding zones (Fig. 3). Prime feeding zones are typically between the lowest/oldest and youngest fully-expanded leaf frond.
 - One easy method is to simply wrap a bundle of net around the inner crown, weaving up to the next frond layer after wrapping the lower layer about twice (Fig. 3). Depending on the width of the net, a typical good net length to measure is approximately twice the height of the feeding zone needing protection. No zipties are required, as zipties can create gaps as the coconut fronds grow and expand (Fig. 4). Here is a QR code for a video with more information on this technique.
 - Other techniques include the Bow-Tie method developed by the University of Guam (2015) and netting the whole tree. However, we have not evaluated the effectiveness and labor of these methods yet.
- Ensure **no gaps** are in the net wrapping (Fig. 4).
- **Keep the net "fluffy"**. This will increase the likelihood of tangling and catching CRB.
- **Readjust the net wrapping at least monthly**. The coconut or palm will continue to grow, creating gaps in the wrapping. This is one step that can make netting traps very labor intensive.



Fig. 3. Coconut tree wrapped with ½" net protecting prime CRB feeding zone



<https://youtu.be/S8ifHs22uBk>



Fig. 4. Examples of poor net wrapping techniques using fixed zipties or leaving exposed frond layers



NETTING MULCH PILES

Minimizing mulch thickness via spreading thinly or completely eliminating mulch from your area are critical management practices to prevent the increase of CRB populations as CRB larvae live in mulch piles. However, if you choose to use mulch in your growing areas, netting mulch piles and debris along with other practices (e.g., avoid storing infested mulch, mulch heat treatments, etc.) can prevent CRB from breeding in mulch piles and reduce the population in an area, as a Guam study found netting mulch piles caught 25x more CRB adults than pheromone traps and other trapping methods (Moore et al. 2014).



As seen in Fig. 5, one “fluffy” layer of ½” monofilament netting is an adequate barrier that catches both CRB adults that try to enter mulch piles but also newly emerged adults attempting to leave and feast on coconut trees. Once caught, CRB adults desiccate and die in the sun.



During an on-farm trial of netting a fresh 20’x6’x2’ mulch pile, netting the pile caught a considerable number of CRB adults entering and exiting the pile (Fig. 6). However, the farmer moved some of the pile on August 2, killing some of the CRB population and disrupting the trial results. As the lifecycle of CRB from egg to adult is about 5-7 months, a repeat of this trial may indicate if netting piles for that time can deplete CRB populations in a pile.

Fig. 5. Mulch piles covered with monofilament netting that catches entering and exiting CRB adults

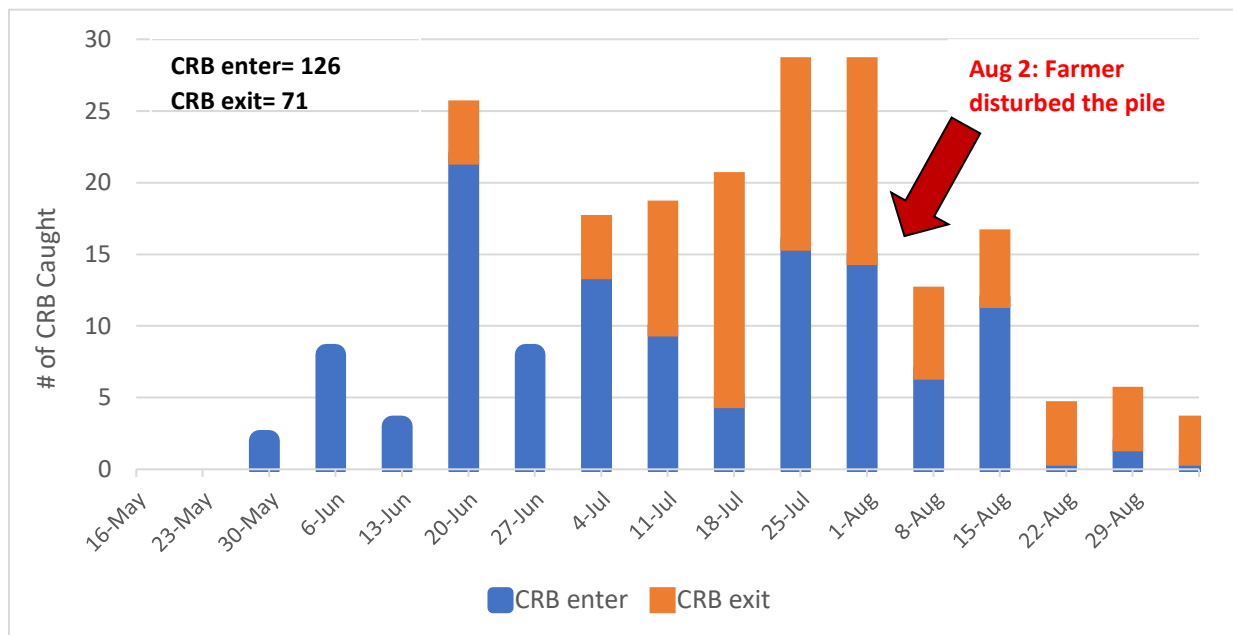


Fig. 6. Netted mulch pile trial (20ft x 6ft x 1ft) monitoring number of CRB caught over 4 months (May 16-Sept 6)



FUTURE WORK

As netting is only one practice of an integrated pest management approach and can be labor intensive, future research is looking into other biological and chemical approaches to kill CRB and protect coconut and palm trees. These include fungal species like *Metarhizium* spp. that infest and kill CRB larvae, essential oil deterrents, drone application of pesticides, and pesticide rotation studies. Be on the lookout for news of these other IPM approaches in the pipeline.

ACKNOWLEDGMENTS

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