Hawaii Department of Agriculture

Pesticide Education Newsletter

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NOTICE - The Pesticide Safety Newsletter normally produced by the University of Hawaii at Manoa College of Tropical Agricultural and Human Resources (CTAHR) Cooperative Extension Pesticide Program is currently on hiatus until the position responsible for creating the newsletter has been filled. In the meantime, to provide Certified Applicators with additional CEU material, the Hawaii Dept. of Agriculture Pesticides Branch, Pesticides Education Section, will produce and make available its own newsletter.

Integrated Pest Management: Tips to Promote Personal and Environmental Safety

Nobody wants pests in their home or garden, but sometimes coming up with a plan to deal with those pests can feel like an overwhelming task. This article, from The University of Florida written by Emily C. Kraus, provides helpful tips, information, and the necessary steps to develop your own integrated pest management (IPM) plan.

The following documents share more detail on developing your own IPM plan. The document can be found at https://edis.ifas.ufl.edu/publication/PI297. It has been added below or those with limited internet access.

INTEGRATED PEST MANAGEMENT GOES HAND-IN-HAND WITH SAFETY

Emily C. Kraus

This publication is geared toward certified pesticide applicators and homeowners who are managing indoor and outdoor pests. It provides a broad definition of a pest and generally describes integrated pest management (IPM) and pest management strategies. It also emphasizes the use of IPM to reduce the development of pesticide resistance and how IPM contributes to personal and environmental safety. As opposed to other EDIS publications which are specific to management areas (e.g., landscape, turf, vegetables), this publication can be used as a base for all sectors of pest management and uniquely promotes the link between IPM and safety.

WHAT IS A PEST?

A pest can be considered any organism that negatively affects humans or human interests. Examples include negative effects on agriculture, human health, recreation, and the economy. An organism can be considered a pest on a case-by-case basis. Some things are nearly always considered to be pests, such as mosquitos in the backyard or flies in the kitchen. This is largely due to the ability of these insects to transmit disease. In other cases, organisms are considered pests because they are in the wrong place at the wrong time. For example, a butterfly may be a welcome visitor in a butterfly garden; however, it can be a pest if the caterpillars are feeding on a crop like citrus, dill, or passionfruit (Figures 1A and 1B). Therefore, the status of being a “pest” is up to the individual managing the home or garden and based upon the specific situation and even personal preferences. Pests may come from any of several major groups including insects, pathogens, nematodes, plants (invasive species, weeds), or vertebrates (things with a backbone).

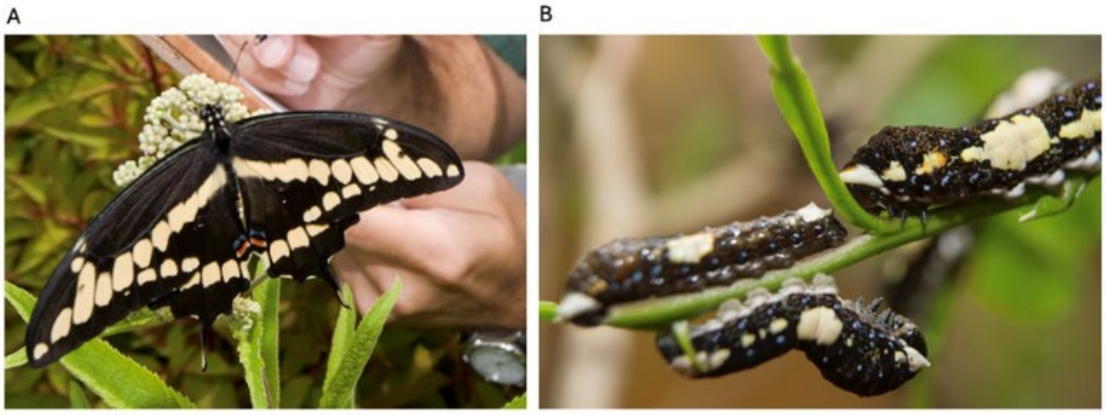


Figure 1. A) An adult swallowtail butterfly, *Papillio aristodemus*, feeds on nectar. B) The larvae will consume many host plants in the family Rutaceae including citrus.
Credit: Tyler Jones, UF/IFAS

INTEGRATED PEST MANAGEMENT

When pests are present, management is essential to protect human interests. Integrated Pest Management (IPM) involves developing a long-term and sustainable plan for managing those pests, using a combination of strategies. Developing an IPM plan requires informed selection and application of pest control measures based on environmental, economic, and sociological consequences. This combined information is used to manage pests with the least possible hazard to people, property, or the environment.

The process of developing an IPM plan can help anyone managing pests stay safe and be cost-effective. The activity encourages thinking through all the steps involved in the management plan for the course of a season or even the whole year. Making this plan and the effort put into forward-thinking assists pest management specialists in fully protecting themselves and the environment. For example, in Florida's summer heat, pest management activities may need to be implemented over a short period of time to avoid heat stress. Planning ahead will ensure this danger can be avoided while pests are being managed.

The stages of IPM may vary depending on the ecosystem in question (i.e., indoors, garden, large agricultural production, or mosquito district) and the target pest. An IPM plan will generally include the following: Identification, Prevention, Monitoring and Setting Action Thresholds, Implementation of Management Methods (Application), and Evaluation. Each IPM step and how they include components of safety are detailed below.

IDENTIFICATION

Proper identification of pests is vital to creating an effective IPM plan (Figure 2). Knowing the identity of the pest will provide information about the pest's lifecycle, biology, and environmental requirements. This information determines the most appropriate management methods, such as targeting pest behaviors. Mistakes in identification can lead to poorly chosen management tactics resulting in lost time and money. This step also has impacts on safety. When the pest is properly identified, the most specific and targeted management methods can be selected. This allows for a reduction in the potential for non-target effects, or accidentally killing other organisms. There are currently dozens of resources both through UF/IFAS and elsewhere that can be used for pest identification. Check out the additional resources at the end of this publication for a few options.

Figure 2. Identification of pests is vital to determining the appropriate management plan. The air potato vine, *Dioscorea bulbifera*, is an invasive vine in Florida and poses a threat to our native species. However, it is frequently confused with several other vines including many species of morning glory and pothos.
Credit: Thomas Wright, UF/IFAS

PREVENTION

This step in IPM focuses on removing or altering conditions such that they are not attractive to pests. The goal is to "prevent" the pest from entering and establishing in an area. Many IPM plans start with prevention due to recurrent pests in the system, or pests that have previously been identified. In most systems, preventing pest establishment can be more economical than implementing methods after they are already established. Prevention may involve several of the management methods detailed below including cultural or physical means. For example, removing empty containers from yards where mosquitos may breed or creating exclusions and barriers to prevent pests from entering homes can be considered preventative. Excluding pests from entering homes or other structures is important to prevent them from establishing indoors (Figure 3). In agricultural and ornamental plant systems, prevention may involve keeping plants healthy, so they are not as susceptible to pests if they do arrive. This could include proper irrigation and fertilization levels. Thus, the step of prevention can improve overall safety by reducing the need for other management strategies.

Figure 3. Squirrels are very cute when they are outside. However, they can do a lot of damage if they make it indoors. Preventing these and other rodents from entering structures is an important component of IPM.
Credit: Thomas Wright, UF/IFAS

POPULATION MONITORING AND SETTING ACTION THRESHOLDS

Monitoring for pests should take place throughout the IPM timeline. The earlier pests are detected, the faster they can be identified, and the more effectively they can be managed. Once pests are identified, action thresholds for the population(s) should be set. An action threshold is the population level where a pest becomes an economic threat, nuisance, or health hazard. In some cases, thresholds may be rather high. This would be the case if the pest causes little damage. In other situations, such as weed control, thresholds may be very low, and methods such as preemergent herbicides may be used. For common or recurring pests, these thresholds can be set in advance of the pests' arrival so that action can be taken quickly according to the IPM plan in place. For sporadic or infrequent pests, thresholds may have to be set by assessing pest populations and damage as they arrive and make themselves at home. Identification, scouting, and predetermined thresholds can contribute to the overall safety of the system. Knowing at what point which strategy will be used allows for appropriate planning, including the selection of the most effective management methods, reduction of non-target effects, and preparation for using pesticides. It is important applicators are prepared to follow all safety measures associated with applying pesticides. More details on pesticide safety are provided in the proceeding "Management Methods" section on chemicals.

MANAGEMENT METHODS

In an IPM strategy, several management methods are used at different points in the program. Some management methods are used in the prevention stage, whereas others will be used after pests are present. The following are examples of different strategies that can be incorporated into an IPM plan either preventatively or after the fact.

CULTURAL

Cultural management tactics reduce pest establishment, reproduction, dispersal, and survival. These strategies are generally preventative but may be used throughout the IPM plan. They involve things like sanitation, plant selection, seed selection (weed-free seed), and proper maintenance practices. For example, in turfgrass management, proper watering and fertilization are vital to producing a healthy turf more resistant to pests. Appropriate cultural management can reduce the need for other methods further down the road, contributing to increased safety for the environment.

BIOLOGICAL

This approach involves the use of natural enemies to decrease the population of the target pest. There are three types of biological control: conservation, augmentative, and classical. Conservation biological control involves maintaining undisturbed natural habitats for native predators and parasitoids. These natural enemies will reduce pest populations through their normal feeding habits. Augmentation biological control involves releasing additional natural enemies into the environment to increase their population numbers. Finally, classical biological control is performed for the management of invasive species. This is generally under the control of governmental agencies as non-native species will be introduced into the environment. It is rare that a pest management professional or homeowner would be actively implementing classical biological control. Managing weed or insect pests through biological control can contribute to both environmental and applicator safety by minimizing non-target effects. Additional resources on this topic are listed at the end of the publication.

MECHANICAL/PHYSICAL

Mechanical or physical methods are exactly what they sound like, mechanically or physically removing pests or using barriers to exclude pests. Examples include pruning, trapping, tilling, and mulching. Hand-picking insects off garden plants is a mechanical control option that can be implemented in small gardens (Figure 4).

Figure 4. Hand-picking insects, like these leaf-footed bugs, off small garden plots can be cost-effective and have no non-target effects. Credit: Tyler Jones, UF/IFAS

This method also contributes to the safety of the environment. Selecting mechanical or physical options allows for a very targeted approach to management and reduces non-target effects. There are also safety considerations for the pest management specialist when using these methods. This includes situational awareness, proper tools, and proper tool use. Appropriate Personal Protective Equipment (PPE) is not just for chemical management. A pest management specialist using mechanical options may need PPE such as cut-resistant gloves and safety glasses.

CHEMICAL

Depending on the system in question and the pests present, chemical management may be the most economical and sustainable solution. This strategy includes using pesticides such as insecticides, herbicides, fungicides, or others. In an IPM plan, the most targeted pesticides should be selected to avoid danger to non-target organisms. The plan should also incorporate the right timing and method of application according to the label. Non-targets are basically anything the pesticide applicator is not trying to repel, damage, or destroy. These may include beneficial nematodes or native plants.

Additionally, there should be a plan for what future applications will look like, if needed, to prevent the development of resistance to pesticides. Resistance occurs when a pesticide is used at the normal label rate but no longer provides the control it has in the past, and the underlying reason is resistant individuals in the population. Continuously using the same types of pesticides may result in the development of resistance and the loss of that product as a tool. An IPM plan should ensure the pesticide applicator carefully considers the available chemical options and rotates the mode of action. Read more about modes of action, or how pesticides kill pests, and pesticide resistance in the blog "A World Without Pesticides" and in the additional resources below.

When using chemical management strategies, all of the components of pesticide safety must be considered. This begins with determining the product or products that will be used, as well as reading all portions of the label and any associated labeling that may be referred to. The label will instruct the applicator on safety from start to end. PPE will be clearly described and may change depending on which part of the mixing and application process is being carried out. The label also includes instructions for appropriately applying the chemical, such as the rate and type of equipment. Precautions for humans and the environment are included. The label will indicate how to safely dispose of or clean used PPE and any leftover product. Finally, the label also describes how to store the chemical properly. There are a variety of resources that cover these topics in detail through the UF/IFAS Pesticide Information Office and its publications.

EVALUATION

An IPM plan must be evaluated from time to time. Applicators should ask themselves, “Is this working?” If not, troubleshoot the methods included in the management plan. Determine if the pest was accurately identified and if the approaches were appropriate. For example, if a pesticide was used, ensure it was used at the right dose and that it was a good choice for that pest. It is also important to consider possible changes in environmental conditions. Evaluation can be very important for safety. This is a good time to consider any parts of the plan that did not go well or acknowledge any time when safety was at risk. Measures can be taken to ensure that risks are reduced in the future. Accordingly, it is also the best time to assess any non-target effects that may have occurred.

IPM PROGRAMS CONTRIBUTE TO SAFETY

Each of the steps in IPM planning is important and contributes to some aspect of safety for people, the environment, and property (Figure 5). The steps of IPM don’t always occur in the same timeline from prevention to evaluation, but each step should get attention at some point. For example, monitoring for pests can occur throughout the timeline of the IPM plan, and action thresholds may be reached more than once, requiring implementation of more than one management method.

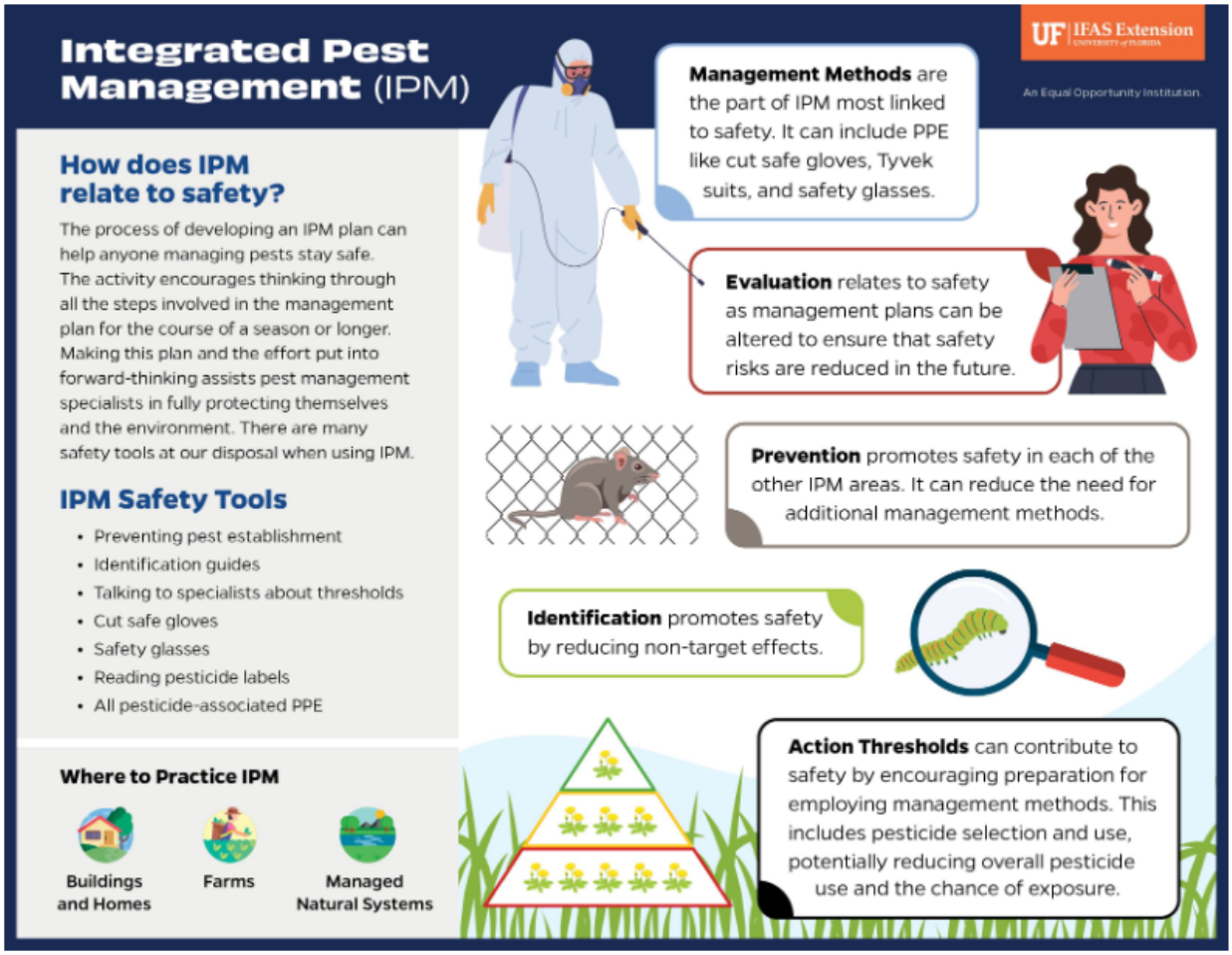


Figure 5. UF/IFAS has created a graphic for relating safety to IPM. It confirms that IPM is important in a variety of ecosystems from the home to the farm to the environment. It also summarizes how each part of an IPM plan can contribute to safety.
Credit: Leah Welch, UF/IFAS

The process of designing an effective IPM plan encourages pest managers to consider all aspects of the system. This reflective process promotes selecting the most effective and least risky strategy. Applicators should invest time in carefully considering the non-target organisms that may be affected by their approach and should minimize any unintentional side effects. The process also results in pest managers ensuring they have the appropriate equipment, including safety gear like PPE. Additionally, investing this time upfront by choosing specific products and thresholds, will provide ample time for applicators to read the entire label of the products they plan to use. This will ensure they have a full understanding of the associated pesticide safety. Taking time to read the label is the best thing a person using a pesticide can do to protect themselves and the environment. Finally, when applicators go through this thought-provoking process, they can take the time to ensure their approach will not lead to pesticide resistance, by allowing for evaluation of the chosen strategy. So, making a good IPM plan goes hand-in-hand with safety!

PPE Closet

Personal Protective Equipment (PPE) is something that nearly all pesticides require an applicator to wear. Not wearing the correct PPE or not wearing all the required PPE is an easy way to become exposed to pesticides. This collection of information, compiled by Wayne Buhler and David Jefferson, covers everything you need to know about selecting the right PPE.

The following documents share more detail on selecting the appropriate PPE. The document can be found at https://pesticidestewardship.org/personal-protective-equipment/. It has been added below for those with limited internet access. Additional training videos can be found on the linked website.

Personal Protective Equipment

Pesticides can pose hazards to humans. The severity of a harmful effect or poisoning depends on the pesticide's chemical makeup and formulation, its path into the body, the amount that enters the body, and the length of exposure. Wearing Personal Protective Equipment, or "PPE", can greatly reduce the potential for dermal, inhalation, eye, and oral exposure, and thereby significantly reduce the chances of pesticide poisoning.

"PPE" refers to clothing and devices worn to protect the human body from contact with pesticides or pesticide residues. PPE includes such items as protective suits, footwear, gloves, aprons, respirators, eyewear, and headgear. When purchasing and prior to using a pesticide product, it is essential that you read ***and understand*** all portions of the pesticide product label. You are legally obligated to follow the instructions and requirements on the label. The label is the law, AND it contains vital information about the use, safety, and handling of the product. Carefully review the signal word, precautionary statements, personal protective equipment requirements, entry restriction statements, emergency first-aid measures, and directions for use – they are included to protect you, others, and the environment.

Different pesticide products require different personal protective equipment. Remember that any product that contains a pesticide – including baits, aerosols, fertilizers, seed, "natural" products, etc. – must be handled using the required PPE, in the correct way. In addition, there are basic PPE principles and practices that must be understood to protect the health and safety of everyone involved in handling a pesticide.

These pages focus on ***many*** of the basics of personal protective equipment (PPE), but do NOT substitute for following the pesticide product label, the PPE user instructions, and all applicable government regulations. To reduce exposure, the required PPE must be handled properly from purchase through disposal, whether you apply a pesticide at home, or work in an agricultural or non-agricultural occupation.

Topics Included in this Module

- The Label and PPE — When using pesticide products, the requirements for PPE on the product label are your main source of information
- Selecting PPE — What to Consider When Selecting Different Types of Personal Protective Equipment
- Components of PPE — It is very important to select the correct PPE. Just as important, the PPE must be working correctly
- Cleaning, Maintenance, Storage, and Disposal — Cleaning and maintenance instructions from the PPE manufacturer must be followed for reusable PPE.
- NIOSH Presentations — Video training

Why the Pesticide Product Label Specifies Personal Protective Equipment

The US Environmental Protection Agency (EPA) requires studies to determine if a pesticide can be registered and how it can be used without impacting health or the environment. To help protect pesticide handlers and early entry workers, the PPE specified on the label must be selected and used correctly, and all other directions and precautions must be followed.

PPE requirements are based not only on protecting the user from acute toxicity concerns but also from other toxicity concerns, such as repeated exposures and how the person would be exposed during mixing, loading and application.

Below is the "Precautionary Statements" section of a label. It contains both the signal word (Danger) and PPE requirements.

PRECAUTIONARY STATEMENTS

HAZARDS TO HUMANS AND DOMESTIC ANIMALS
DANGER

Poisonous if swallowed, inhaled, or absorbed through the skin. Rapidly absorbed through the skin. Wear protective clothing and gloves. Wash thoroughly with soap and water after handling and before eating, drinking, or using tobacco. Do not get in eyes, on the skin, or on clothing. Remove contaminated clothing and wash before reuse. Do not breathe dust.

Personal Protective Equipment

Applicators and other handlers must wear:

- **Coveralls *over*** short-sleeved shirt and short pants
- Chemical-resistant gloves
- Chemical-resistant footwear plus socks
- Chemical-resistant headgear for overhead exposure
- Chemical-resistant apron when cleaning equipment, mixing, or loading
- For exposures in enclosed areas, a respirator with either an organic vapor-removing cartridge with a pre-filter approved for pesticides (NIOSH approval number prefix TC 23C) or a canister approved for pesticides (NIOSH approval number prefix TC14G) or a NIOSH approved respirator with an organic vapor (OV) cartridge or canister with any N, R or P pre-filter.
- For exposures outdoors, dust/mist filtering respirator (NIOSH approval number prefix TC-21C) or a NIOSH approved respirator with any N, R or P filter.

Follow manufacturer's instructions for cleaning/ maintaining PPE. If no such instructions for washables, use detergent and hot water. Keep and wash PPE separately from other laundry.

Personal Protective Equipment Requirements on the Pesticide Product Label are Revised Frequently

Pesticide product labels undergo scheduled reevaluations, and can also be changed at any time due to new research and/or regulatory requirements. So read the entire label every time you purchase a pesticide product. The same applies to any PPE instructions that accompany the PPE – read them carefully every time you purchase the PPE, even if you purchased the same brand and model before.

What to Consider When Selecting Different Types of Personal Protective Equipment

Correct selection of PPE is the first critical step. Follow the *pesticide product label* carefully when certain types of gloves, respirators, and/or other PPE are specified. For example, a specific type of glove material may be highly chemical-resistant to some pesticide products but not others. A respirator suitable for one task may not be suitable for another. "Water-resistant" material is different than a "chemical-resistant" material.

"Chemical-resistant" PPE is "material that allows no measurable movement of the pesticide being used through the material during use." ***However, "chemical-resistant" aprons, coveralls, eye protection, footwear, gloves, and headgear are not equally resistant to all pesticides, under all conditions, and for the same length of time***.

Read the ***PPE user instructions*** carefully to ensure that the PPE meets the specifications on the particular pesticide product label. If in doubt about what PPE to use, call the pesticide product manufacturer, the PPE manufacturer, your county agent, or your state's pesticide safety education program. Pesticide labels, PPE instructions, and safety equipment catalogs contain phone numbers, and PPE manufacturer websites often contain detailed information on their products.

More is not necessarily better in the case of PPE – select the PPE required by the label.

Make Sure PPE is Working Properly

It is very important to select the correct PPE. ***Just as important***, the PPE must be working correctly every time you use it, either alone or in combination with other PPE. When several pieces of PPE are used together, they must not interfere with each other. For example, protective goggles must not interfere with the operation of a respirator.

Read the PPE user instructions carefully before every use, and seek assistance if needed.

Before and after every use, check for any type of deterioration of, or damage to, all the components, seams, etc. of the specific reusable PPE and, if necessary, dispose of it properly.

Components of Personal Protective Equipment

It is very important to select the correct PPE. ***Just as important***,the PPE must be working correctly every time you use it, either alone or in combination with other PPE. Read the PPE user instructions carefully before every use, and seek assistance if needed.


Photo: WSU

Aprons, when required, must be made of chemical-resistant material and cover the front of the body from mid-chest to the knees. It is a good idea to wear an apron whenever mixing or loading chemicals or cleaning spray equipment, even when not required on the pesticide label.

Coveralls are loose-fitting one- or two-piece garments that cover, at a minimum, the entire body except the head, neck, hands, and feet. The pesticide label may specify that the coveralls be worn over a layer of clothing. Most coveralls are made of fabric such as cotton or a cotton-polyester blend and are not chemical-resistant. There are laminated or coated materials that provide water resistance and protection from some solvents, but no US certification currently exists.

Eye protection requirements may be shielded safety glasses, goggles, a face shield, or a full-face respirator. Shielded safety glasses have a brow cover and side shields. Special goggles are needed when wearing a half-mask respirator or prescription glasses. Straps on eye protection equipment should be worn under any required protective headgear. There is an important difference between chemical goggles and ordinary safety goggles. Chemical goggles have a baffled airway that prevents a direct splash from getting inside the goggles. Ordinary safety goggles do not have this feature.

Footwear includes waterproof boots, or chemical-resistant boots or shoe coverings, worn over regular shoes or boots. Ensure that the footwear chosen will not absorb the spray. Always wear the pant legs ***outside*** the footwear to prevent spray from running down the leg into the footwear. Duct tape can be used to temporarily seal the area where boots meet the pants. Exposed footwear should be cleaned after each day's use, and never worn indoors.

Glove(s) materials differ in their protective ability and the length of time they are protective after contact with the specific pesticide. The level of protection also varies depending on whether diluted sprays, concentrated product splashes, granules, or powders contact the gloves.

Pay careful attention to the glove types specified on the pesticide label. Some of the more common types of chemical-resistant gloves are made of nitrile, neoprene, and butyl rubber. Waterproof gloves are highly protective only for dry and water-based formulations. ***Pesticide labels will usually list "examples" of suitable glove types.***

Butyl Rubber glove

Barrier Laminate

Nitrile glove

Always wear unlined gloves, and never wear canvas, leather, cotton, or other fabric gloves unless specified on the pesticide product label. Even highly chemical-resistant gloves must be rinsed off at breaks if pesticide contact occurs.

Wear sleeves outside the gloves if spraying below the shoulders. If spraying overhead, gloves should be outside the sleeves. If spraying both overhead and below the shoulders, duct tape can be used to temporarily seal the area where the gloves meet the sleeves. Elbow-length gloves are more protective and are required for some activities.

Headgear includes chemical-resistant hoods and chemical-resistant hats with a wide brim. Some labels require headgear – ensure that the headgear chosen will not absorb the spray.

Respirator requirements on pesticide labels are very specific when required for pesticide handling tasks. See the module on Respirators within this website for more detailed information. Use only respirators approved by the National Institute for Occupational Safety and Health (NIOSH). See the OSHA Respiratory Protection Regulation (29 CFR).

If you are required by the pesticide label to use a respirator an initial medical evaluation is also required by law.

Self-contained, canister and cartridge style respirators require a tight seal to the face and must be ***fit tested*** before use. Fit testing is also required annually, ***or*** when the type of respirator changes, ***or*** when there are significant changes in weight or facial features.


http://info.lu.farmingdale.edu

Only a trained person or safety professional should conduct the fit testing, according to the instructions included with the respirator or other fit test protocols specific to the model. Tight-sealing respirators cannot be worn by persons having facial hair (such as beards), jewelry, or other obstructions where the respirator contacts the face.

A respirator ***seal check*** (also known as a pressure check or fit check) is a very different procedure than a fit test. A seal check determines the effectiveness of the seal between the respirator and the skin and must be done EVERY time the respirator is worn. Follow the PPE instructions to conduct a proper seal check.

Replace filters, canisters, cartridges, etc. according to the pesticide label or PPE instructions (whichever is more frequent), ***and*** whenever there is equipment damage, breathing resistance, odor, taste, irritation, or soiling. Following the PPE instructions for replacement is critical, because other indicators are not always dependable. For example, the ability to detect an odor depends on the product, the person, and the weather conditions, and the mere presence of an odor does not indicate that harm can result.

Cleaning, Maintenance, Storage and Disposal

Cleaning and maintenance instructions from the PPE manufacturer must be followed for ***reusable*** PPE. Never reuse any type of disposable (one-time use) PPE equipment, because you can be exposed to residues remaining on the PPE from the previous use, or to product moving through damaged or deteriorated PPE during reuse.

Note that reusable or limited-use PPE must be discarded if not cleaned and maintained properly because there is a significant risk of pesticide exposure. For example, pesticide exposure can occur from residues remaining from the previous use, damaged seals in the respirator, small holes or tears in gloves or clothing, or degradation of the chemical-resistant PPE.

Remove PPE as soon as you complete the tasks where you were exposed to the pesticide. Wash disposable OR reusable gloves with soap and water, and then remove other PPE while still wearing the gloves. Then wash the gloves again with soap and water before removing them. Clean reusable PPE according to the PPE instructions, without causing contamination to yourself. Washing gloves prior to removal avoids contamination, shown at right.

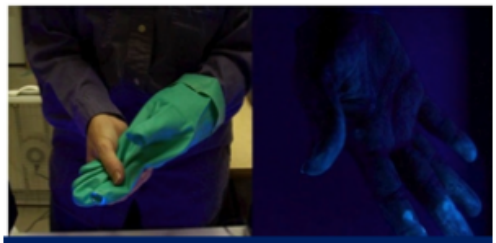


Photo: High Plains Center for Ag Health and CSU

Wash regular work clothes that have been exposed to pesticides ***as soon as possible*** to ensure maximum pesticide residue removal. Wash them separately from other laundry using detergent and hot water. Using an outdoor clothesline rather than a dryer may help break down any remaining pesticide residues. If no PPE is required on the pesticide label, it is still wise to wash clothes promptly.

Always obtain replacement parts for half and full-face respirators from the original manufacturer and repair PPE in accordance with manufacturer instructions. Respirator component parts are NOT interchangeable between different manufacturers.

Storage instructions from the PPE manufacturer must be followed for both reusable and disposable PPE. Most PPE must be protected from chemicals, sunlight, extreme temperatures, excessive humidity, and moisture, or the specified shelf-life will be reduced. Disposable, reusable, or limited-use PPE must be discarded if not stored properly.

Keep PPE in its sealed package until use, and never store PPE with pesticides or personal clothing.

Photo: rhpracking.com

Disposal is the critical last step in handling PPE. Ensure that you remove and discard PPE without causing contamination to yourself, garbage collectors, or the environment. PPE may have an expiration date, while other PPE requires careful inspection – read the PPE manufacturer directions and be diligent about the disposal of PPE that will no longer provide protection.


trashcansunlimited.com

Clean disposable, washable items with soap and water prior to disposal, to remove pesticide residues. Properly cleaned PPE can be disposed of as regular garbage.

PPE that is contaminated with a pesticide must be disposed of according to directions on the pesticide product label and all federal, state, and local regulations. In the absence of specific label directions or government regulations, dispose of contaminated PPE as household hazardous waste, which can be taken to an appropriate waste collection event or disposal site.

If all PPE instructions for cleaning, maintenance, storage, and disposal are not followed carefully, PPE can become ineffective or even increase exposure to a pesticide. If in doubt, dispose of the PPE or PPE component.

Compiled by *Wayne Buhler, PhD and David Jefferson MS*

NC State University A&T State University COOPERATIVE EXTENSION
Empowering People · Providing Solutions

Coconut Rhinoceros Beetle: Statewide Communications Plan

CRB has been reported on O'ahu, Kauai, Maui, and Big Island. But they are most widespread on O'ahu. This invasive species poses a serious threat, not only to coconut trees, but also to our endemic loulu palms. But what can we do to mitigate the threat posed by these beetles? This statewide communication plan details how you can identify CRB, protect your home and business, and contribute to the greater efforts to control and hopefully eradicate this invasive species wherever possible.

The following documents share more detail on controlling and mitigating the threat from CRB. The entire document can be found at https://dlnr.hawaii.gov/hisc/files/2024/03/Hawaii-CRB-Communications-Plan-2024.pdf. Relevant portions of the document have been added below for those with limited internet access.




COCONUT RHINOCEROS BEETLE

Statewide Communications Plan

This document was produced through a collaborative effort:

Department of Agriculture
STATE OF HAWAII

HOW TO USE THIS PLAN:

This communications plan empowers educators, organizers, community leaders, and outreach specialists with CRB knowledge and messaging tools.

Use the plan to:

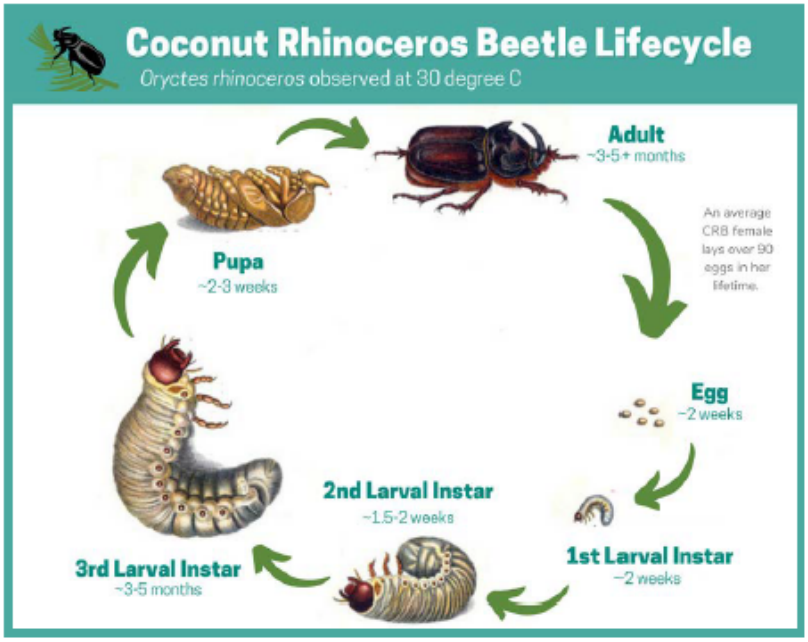
- Learn essential CRB information (identification, impacts, management)
- Find tailored messages for diverse audiences
- Engage stakeholders and amplify your efforts to protect our islands

Stakeholder messages have been divided into messages and key actions for "infested" islands and "non-infested" islands:

INFESTED ISLAND	NON-INFESTED ISLAND
An island where CRB populations have become established (e.g. O'ahu). Management efforts on infested islands often focus on mitigation and control measures to reduce CRB populations and minimize damage. Individuals, communities, and land owners assume control.	An island where CRB populations have not become established or are present at low levels (e.g., other islands in the state). Management efforts on uninfested islands typically focus on prevention, early detection, and rapid response measures. Resources/assistance may be available from agencies.

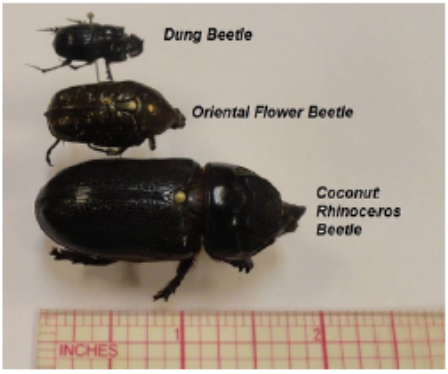
WHAT IS CRB?

The Coconut rhinoceros beetle *(Oryctes rhinoceros)* is a destructive pest species that primarily targets coconut palms and other palm species. Native to Southeast Asia, it has spread to many tropical and subtropical regions worldwide, including Hawai'i. The beetle was first detected on the island of O'ahu in December 2013. Adult beetles are large, usually dark brown or black, with a characteristic horn-like projection on their heads, resembling that of a rhinoceros hence the name. They feed on the tender tissues of coconut palms, causing damage to growing tips, leaf bases, and even the heart of the palm. This feeding activity weakens the palm, making it more susceptible to other pests and diseases and ultimately leading to stunted growth, reduced yield, and in severe cases, palm death.

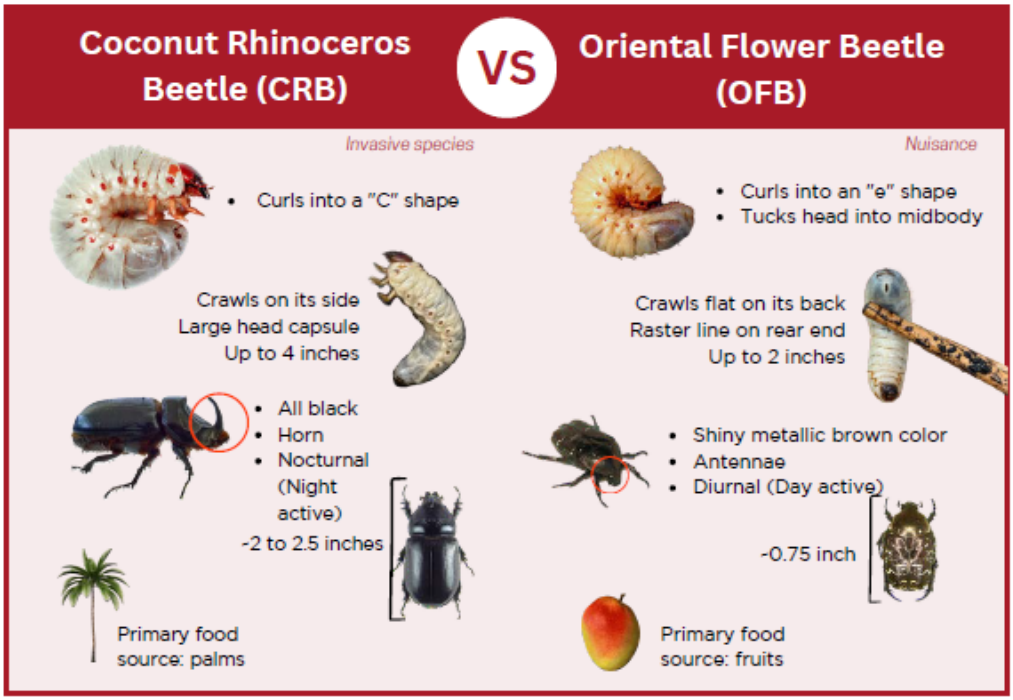


IDENTIFYING CRB

There are several beetles in Hawai'i that look similar to Coconut Rhinoceros Beetle. Dung beetles and Oriental flower beetles are common look-a-likes that often get reported. The major differences between CRB and other beetles include size, appearance, food sources, and the time day that adult beetles are active.



To identify a suspected CRB, send pictures to 643pest.org or call (808) 643-PEST (7378). For larvae, photograph both top and bottom and capture a short video of the larvae crawling on a flat surface. For adult beetles, take a clear picture with a ruler for scale. On non-infested islands, keep the specimen until identification can be confirmed. See pg. 55 for more details one what to do with CRB specimens.



Oriental flower beetle (*Protaetia orientalis*) is fairly widespread across Hawai'i and is often mistaken for the Coconut rhinoceros beetle (*Oryctes rhinoceros*).

PRIMARY FOOD SOURCES IN HAWAI'I:


Coconut palms


Royal palms


Date palms


Fan palms

CRB are not host-specific; if their primary food sources are unavailable, they feed on other palms and other agriculturally and culturally important plants.

SECONDARY FOOD SOURCES IN HAWAI'I:


Foxtail palms


Sago palms


Pineapple


Kalo


Banana


Sugarcane


Hala

Other food sources? CRB can also feed on many other palm species, usually preferring those with thicker trunks. Ongoing research at the University of Hawai'i is exploring other potential food sources in Hawai'i.

Department of Agriculture
STATE OF HAWAII

HIGH-RISK MATERIALS

for breeding and larval growth

CRB lay eggs in decaying plant matter but they prefer coconut debris, tree stumps, mulch, compost, and various gardening materials. CRB larvae (grubs) have been found in other places like dirt, grass clippings, planter boxes, a dead root of a living citrus tree, the tops of palms, and leaf litter.


Compost


Mulch


Stumps


Whole green waste


Dead trees


Bagged soil, compost, mulch


Logs


Potted plants

Potting mix

SIGNS OF INFESTATION:

Adult beetles feed on the inner spear or heart of the palm. Using their strong front legs and horn, they burrow into the palm and suck the juices they extract. The damage left behind can vary depending on the plant species.

45-degree v-cuts:

2-inch bore holes:

Scalloped edges & snowflake patterns:

WHY SHOULD WE CARE?

Environmental Impacts

- The loss of loulu (*Pritchardia* spp.), our native fan palms, which are especially susceptible to CRB damage, impacts both biodiversity and cultural uses
- Increased coastal erosion due to loss of coastal vegetation
- Increased need for insecticides for mitigation measures
- The full extent of CRB's effects on ecosystems, including pollinators and decomposers, remains uncertain, posing risks to ecosystem functioning and resilience

WHY SHOULD WE CARE?

Economic Impacts

- Reduction of private property values
- Loss of tourism and negative impacts to visitor experience
- Increased costs associated with removing and replacing dead palms
- Loss of yield in commercial palm production
- Increased costs from mitigation measures
- Increased number of hazard trees and damage after storms

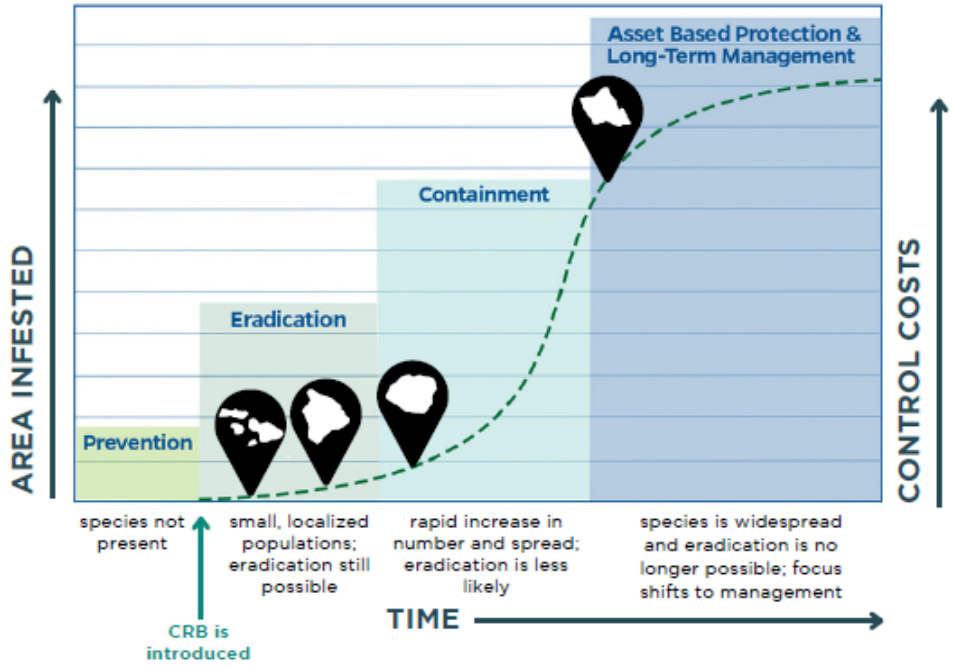
WHY SHOULD WE CARE?

Cultural and Social Impacts

- Loss of medium for cultural practitioners, including weavers and hula practitioners
- Loss of crucial subsistence crops and unique coconut varieties
- Endangers sacred coconut groves, such as Kapuāiwa on Moloka'i and Wailuanuiahō'ano groves on Kaua'i
- Disrupts sustainable agricultural practices and threatens composting and organic farming efforts

CURRENT STATUS OF CRB

Invasion Curve By County (updated February 2024)



Prevention	Eradication	Containment	Management
Pre-border inspection and border detection	Delimiting surveys and treatment	Delimiting surveys and treatment prioritizing outlying infestatons	Support landowner treatment, reduce pest densities at outgoing ports
Interstate quarantines and port prevention	Local quarantines and BMPs	Local quarantines and BMPs	Intrastate quarantines and BMPs

Outreach to stakeholders and homeowners, research, collaboration, and communication are critical throughout all stages of pest management.

Department of Agriculture
STATE OF HAWAII

GENERAL PUBLIC

Residents, Renters, Homeowners

Key Messages/Actions:

INFESTED ISLAND

Inspect and Report

Inspect host plants for damage and any high-risk materials for presence for CRB. Kill any CRB found.

Manage High-Risk Materials

Remove dead standing palms, stumps, and snags including roots.

Don't stockpile or move green waste or other high-risk materials without thorough inspection or proper treatment.

Use wood mulch alternatives such as weed mats, gravel, rubber chips, etc.

Prevent the Spread

Store bags of soil, compost, and mulch in a sealed, CRB proof container (thick plastic).

Don't purchase bags of gardening material with CRB damage and inform store employees.

Stay Informed

Keep yourself and others informed and engaged with the latest CRB prevention and control strategies.

Ask your landscapers, nurseries, and waste disposal sites about their CRB prevention and management practices.

Give business to companies that actively employ these best management practices.

Note: If CRB is no longer eradicable on your island, responsibility for control shifts to private landowners. In cases of limited infestations, agencies may offer resources and assistance.

Department of Agriculture
STATE OF HAWAII

GENERAL PUBLIC

Residents, Renters, Homeowners

Key Messages/Actions:

NON-INFESTED ISLAND

Inspect and Report

Inspect host plants for damage and any high-risk materials for presence for CRB.

If you suspect CRB Report to 643pest.org or call (808) 643-PEST (7378).

Take photos of feeding damage or beetles. For larvae, take a brief video of it moving on a flat surface. Store specimens until ID'd. See pg. 55 for more info.

Prevent the Spread

Don't import or purchase host plants or high-risk materials from CRB infested areas.

Before purchasing bagged gardening materials, inspect for presence of CRB or damage on host plants.

Participate in a community CRB trapping program to support early detection efforts.

Manage High-Risk Materials

Remove dead standing palms, stumps, and snags including roots.

Reduce stockpiling high-risk materials to prevent breeding.

Use wood mulch alternatives such as weed mats, gravel, rubber chips, etc.

Educating everyone on CRB identification is essential for early detection. Training should emphasize symptoms of infestation and the importance of prompt reporting.

Stay Informed

Keep yourself and others informed and engaged with the latest CRB prevention and control strategies.

Department of Agriculture
STATE OF HAWAII

LANDSCAPE PROFESSIONALS

Nurseries, Arborists, Tree Trimmers, and Landscapers

Key Messages/Actions

INFESTED ISLAND

Inspect

Inspect high-risk materials and host plants for CRB or damage.

If present, notify the property owner and kill any CRB found.

Manage High-Risk Materials

Treat palms with pesticides if there is an active infestation.

Treat high-risk materials before moving/removing materials on infested islands.

Remove dead standing palms, stumps, and snags including roots.

Don't stockpile green waste, compost, mulch, or potting medium for more than 4 months (unless in a sealed, CRB-proof container).

- If not possible, thoroughly search through high-risk material every 4 months.

Prevent the Spread

Don't move or sell plants with suspect or recent CRB damage.

Source compost, mulch, steer manure, and other materials from as local as possible and check regularly for presence of CRB.

Deliver green waste to an official processing facility in a timely manner.

Stay Informed

Receive staff training and updates on CRB and Best Management Practices (BMPs) from either CRB Response or your island ISC.

A thorough palm inspection involves checking for any sign of CRB at the crown, trunk and root area. An inspection should be done before transport.

Department of Agriculture
STATE OF HAWAII

LANDSCAPE PROFESSIONALS

Nurseries, Arborists, Tree Trimmers, and Landscapers

Key Messages/Actions

NON-INFESTED ISLAND

Inspect and Report

Inspect host plants while trimming. Look for damage to the crown and the root ball.

If you find CRB or damage, take photos and report it to 643pest.org or (808) 643-PEST (7378).

Hold onto specimen until ID'ed. Take clear pictures and short videos of larvae on a flat surface. For more info see pg. 55.

Prevent the Spread

Don't import CRB host plants from infested areas.

Deliver greenwaste to an official processing facility in a timely manner.

Source compost, mulch, steer manure, and other materials from as local as possible and check regularly for presence of CRB.

Manage High-Risk Materials

Remove dead standing palms, stumps, and snags including roots.

Don't stockpile green waste, compost, mulch, potting medium for more than 4 months (unless in a sealed, CRB-proof container).

- If not possible, thoroughly search through high-risk material every 4 months.

Stay Informed

Receive staff training and updates on CRB and Best Management Practices (BMPs) from either CRB Response or your island ISC.

Refer to CRB Management Guide pg 53-57 and the resources (pg 59) for up to date sources of information.

Provide customers pamphlets and other resources on CRB. Contact CRB Response or your local ISC for materials.

Department of Agriculture
STATE OF HAWAII

FARMERS

Key Messages/Actions

INFESTED ISLAND

Inspect and Report

Inspect host plants for damage and any high-risk materials for presence for CRB. Kill any CRB found.

Manage High-Risk Materials

Remove dead standing palms, stumps, and snags including roots.

Use wood mulch alternatives such as weed mats, gravel, rubber chips, etc.

Monitor mulch & compost regularly. Inspect every 4 months by turning over thoroughly using hand tools or equipment.

Don't stockpile green waste or high-risk materials for more than 4 months (unless in a sealed, CRB-proof container).

- If this is not possible, keep green waste material whole and inspect for CRB before chipping, grinding, or processing for use or transport.

Prevent the Spread

Don't import host plants, soil, compost, or mulch from infested areas.

Source compost, mulch, steer manure, and other gardening materials from as local as possible.

Stay Informed

Receive staff training and updates on CRB and Best Management Practices (BMPs) from either CRB Response or your island ISC.

Reducing the amount of high-risk material is important, Weed mats are a mulch alternative for weed suppression.

Department of Agriculture
STATE OF HAWAII

FARMERS

Key Messages/Actions

NON-INFESTED ISLAND

Inspect and Report

Regularly inspect host plants for damage and high-risk materials for presence for CRB.

Report CRB or damage to 643PEST.org or (808) 643-PEST (7378) and take clear photos/video.

Hold onto specimen until ID'ed. Take clear pictures and short videos of larvae on a flat surface. See pg. 55 for more info.

Manage High-Risk Materials

Remove dead standing palms, stumps, and snags including roots.

Monitor mulch & compost regularly. Inspect mulch every 4 months. Turn it over thoroughly using hand tools or equipment.

Use wood mulch alternatives such as weed mats, gravel, rubber chips, etc.

- If this is not possible, keep wood mulch layer to 2 inches or less.

Prevent the Spread

Don't import host plants, soil, compost, or mulch from infested areas.

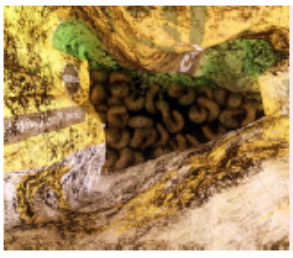
Install and regularly check CRB traps around the farm's perimeter for early detection.

Source plants and gardening materials from as local as possible.

- Consider a designated quarantine area for new plants and materials.
- Always inspect material while using.

Stay Informed

Train staff to identify and report CRB and damage to plants and bagged gardening materials.



Larvae are being transported via bagged soil and mulch. Always inspect your gardening materials for signs of CRB!

Department of Agriculture
STATE OF HAWAII

GOLF COURSES

Key Messages/Actions

INFESTED ISLAND

Inspect

Inspect host plants for CRB damage and high-risk materials for the presence of CRB every 4 months. Kill any CRB found.

Manage High-Risk Materials

Remove dead standing palms, stumps, and snags including roots.

Use wood mulch alternatives such as weed mats, gravel, rubber chips, etc.

Don't stockpile high-risk materials for more than 4 months (unless in a sealed, CRB-proof container)

- If this is not possible, keep green waste material whole and inspect for CRB before chipping, grinding, or processing for use or transport.

Prevent the Spread

Don't import palms, soil, compost, mulch, and plants from infested areas.

Source plants, compost, mulch, steer manure, and gardening material from as local as possible.

Deliver greenwaste to an official processing facility in a timely manner.

Protect palms with treatments.

Require CRB BMPs for contracted landscaping services.

Receive training and updates on CRB identification, infestation status, and Best Management Practices (BMPs) from CRB Response or your island ISC.

If an active infestation is present, use recommended pesticides and stay up-to-date on treatment strategies.

Some golf courses on O'ahu are seeing widespread palm death and a decline in the aesthetic of surviving palms. Damage to palms is unsightly and eventually the palms will die. If you want to maintain the aesthetic, it may require removal and replanting which is costly.

Department of Agriculture
STATE OF HAWAII

GOLF COURSES

Key Messages/Actions

NON-INFESTED ISLAND

Inspect and Report

Regularly inspect plants for damage and high-risk materials for presence of CRB.

Report CRB or damage to 643PEST.org or (808) 643-PEST (7378) and take clear photos/video.

Hold onto specimen until ID'ed. Take clear pictures and short videos of larvae on a flat surface. See pg. 55 for more info.

Prevent the Spread

Don't import palms, soil, compost, mulch, and plants from infested areas.

Source plants, compost, mulch, steer manure, and gardening material from as local as possible.

Install, maintain, and regularly check CRB traps around perimeter. Request from your island ISC.

Manage High-Risk Materials

Remove dead standing palms, stumps, and snags including roots.

Use wood mulch alternatives such as weed mats, gravel, rubber chips, etc.

- If this is not possible, keep wood mulch layer to 2 inches or less.

Don't stockpile high-risk materials for more than 4 months (unless in a sealed, CRB-proof container).

- If this is not possible, inspect materials every 4 months.

Stay Informed

Receive training and updates on CRB identification, infestation status, and Best Management Practices (BMPs) from CRB Response or your local Invasive Species Committee.

- Require landscaping contractors to also complete trainin

Provide customers pamphlets and other resources on CRB. Contact CRB Response or your island ISC for materials.

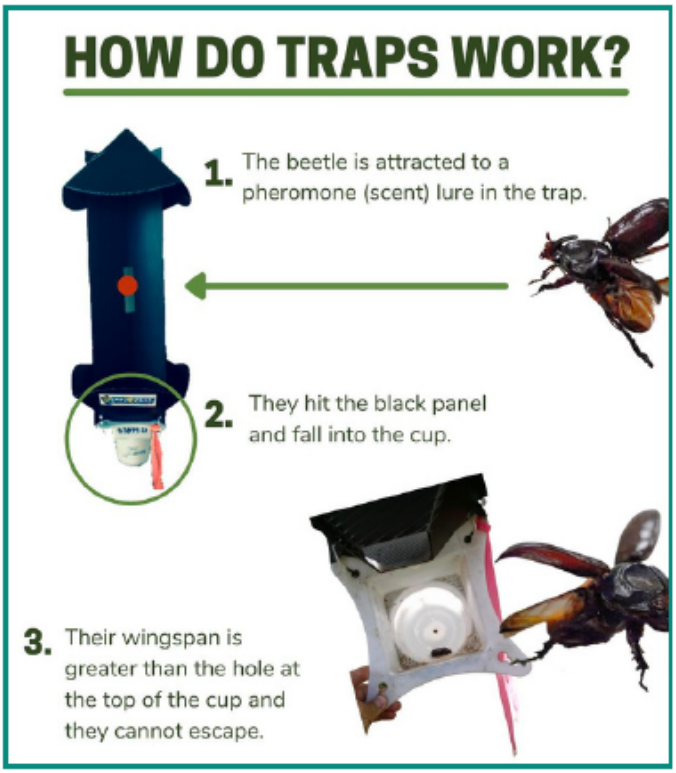
Always exercise caution when importing CRB host palms from infested areas, like O'ahu.

TRAPS FOR EARLY DETECTION & MONITORING

CRB traps are the best tool available for early detection in non-infested areas. It can take months for "V" cuts and bore holes to show up on trees, whereas traps will catch a percentage of the beetles in an area in much less time. Traps are not an effective tool for control.

Why use detection traps?

- Best available tool for detecting new infestations
- Ease of checking compared with searching through green waste
- Allow for monitoring across a large area
- Complement other detection methods



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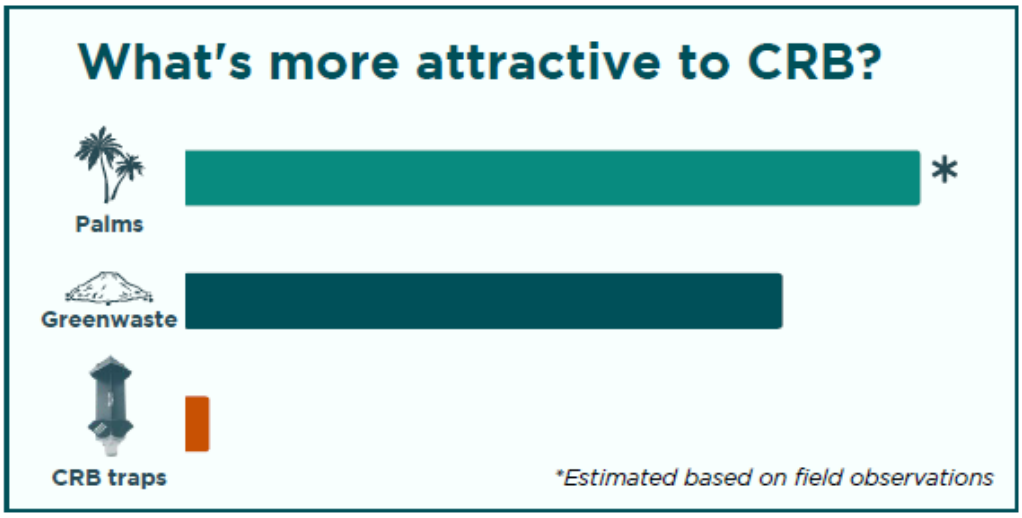
TRAPS FOR EARLY DETECTION & MONITORING



One of the most common questions we get asked is if hanging a trap will attract CRB over to your property. The pheromone lure lasts around 3 months and will attract adult CRB from around 5-50 feet away, depending on wind conditions. CRB traps don't have a far range and will only detect beetles already in the area.

In choice tests, CRB are most attracted to palm crowns, then high-risk materials like mulch or compost, then traps. Green waste was 26 times more attractive than the trap lure in a field comparison. Coconut palms are even more attractive.

So why use traps? Though CRB frond damage eventually becomes visible, traps offer much earlier detection compared to relying on visual inspections alone. This head-start gives us the best chance for successful management.



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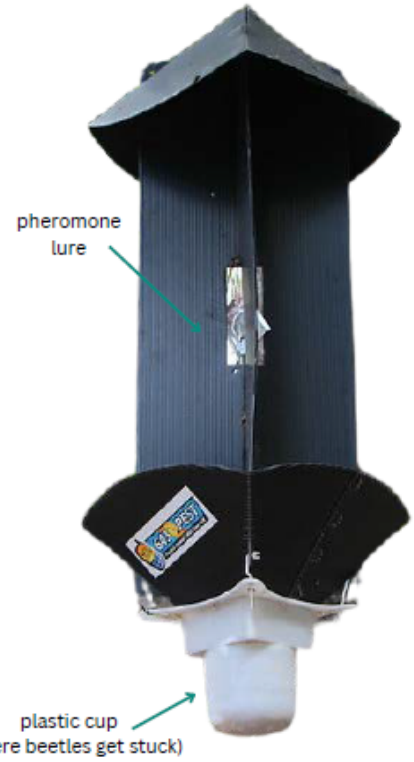
CRB COMMUNITY TRAPPING PROGRAMS

What are the community trapping programs?
Early detection on all islands is increasingly important as the risk for transporting CRB grows. Community members and organizations in non-infested areas are able to maintain a CRB trap where more coverage is needed and be proactive in early detection efforts. Community trapping programs distribute traps and support trap checks and maintenance.

Can I get my own trap? What are the requirements/ commitments if I get a trap?
Not everyone will get a trap and trap distribution will be determined based on the proximity of your site to existing traps. To participate in the programs, people must first take a simple training on trap maintenance and data recording.

Where should I place my trap?
Traps should be hung in a secure place on the property, where beetles can fly in from any direction. It's not recommended to hang on or next to a host plant or next to breeding material, as these would likely be more attractive than the trap.

How do I maintain my trap? How often do I check my trap? How do I submit my trap checks and detections?
Participants will be given a simple training on trap checks and data recording. If CRB are found in the trap, immediately remove and store in a glass jar in the freezer and report to 643PEST.org or call (808) 643-PEST (7378).



Contact the CRB Response or your island ISC to join the early detection trapping effort:

- Kaua'i: kisc@hawaii.edu
- Maui: miscpr@hawaii.edu
- Moloka'i: molokaimisc@gmail.com
- Hawai'i: biisc@hawaii.edu
- General Inquiries: info@crbhawaii.org

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CRB MANAGEMENT TOOLS

Treatments known to kill CRB

There is no single treatment currently available to completely rid an area of CRB but there are several treatments and practices that can reduce the impacts of CRB. Here is a list of methods known to kill all life stages of CRB in infested material. If the high-risk material is subjected to a kill treatment every four months, the CRB growing in the material will be killed before they have a chance to mature and fly away.

Chipping: The cutting action kills all life stages. Chips can be infested immediately after processing so storage or transport should be done on the same day. **Use this method for tree and palm waste (logs, branches, stumps, fronds, leaves).**

Hot compost: CRB begin to die around 115° F but 131°° F core temp is a good target to ensure that even the colder spots, or edges and areas touching soil are at least 115° F. **Use this method for mulch (chipped wood and plant material) and non-woody plant waste (grass clippings, leaves, fruits, veggies).**

Submerge: Complete submersion of high-risk material underwater for at least 48 hours. Adults may escape but all immatures should die. **Use this method for finished compost and gardening materials such as soil, mulch, peat, coconut coir.**

Steam: Steam takes a long time to penetrate deep and fine material. You must measure the core of the material to ensure that all material reaches 120° F for at least 1 hour. Use of a sealed container, vacuum system, and perforated piping can speed up the process. **Use this method for tree and palm waste, mulch, finished compost, soil, and non-woody plants.**

Fumigate: Sulfuryl fluoride (Profume, Vikane) can be applied by a certified applicator. This is the same chemical used to fumigate homes for termites. Other fumigants may work but have not been tested on CRB yet. **Method effective on tree and palm waste, mulch, finished compost, soil, and non-woody plants.**

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CRB MANAGEMENT TOOLS

Treatments known to slow CRB growth

CRB breed in decaying plant material (not just palm). Mulch and compost are ideal but stumps, leaves, lawn thatch, rich soil and leaf/frond debris and rotting areas in palm crowns are also suitable. CRB adults burrow into the heart of host plants to feed. Use these methods to slow the growth of CRB populations. Treatment recommendations may change with new research. Refer to crbhawaii.org for the latest recommendations.

Grind: Grinding will kill some CRB but kill rates have not been tested. Finer (smaller particle size) grinding is more likely to kill more CRB. Use this method for tree and palm waste (logs, branches, stumps, fronds, leaves).

Burial: CRB are very good diggers but burial will probably mask the smell of decomposing materials and requires more work for CRB to reach. Use this method for mulch (chipped wood and plant material), finished compost, soil or planting media, and non-woody plant waste.

Till in: Tilling material into soil reduces the scent, access, and calories per volume available to CRB. The smaller the organic component of the soil is, the lower the attractiveness will be to CRB. Use this method on mulch, finished compost, soil or potting media.

Spread thin: Spreading mulch and compost thinner than 2 inches dries out the material faster and allows predators (chickens and mongoose) to find CRB. If material stays moist or is irrigated this is not a treatment for CRB. Use this method on mulch, finished compost, soil or potting media.

Green waste management has proven to be the most effective method for reducing beetle populations. In areas where beetle populations have been significantly reduced and tree recovery has been successful, green waste management was a crucial factor. Homeowners on O'ahu are encouraged to dispose of their green waste in the city and county's designated green waste bins, as it is then transferred to a treatment facility.

Department of Agriculture
STATE OF HAWAII

CRB MANAGEMENT TOOLS

Treatments known to slow CRB growth

Tarping: Tarps can reduce the available scent but they can also keep material moist which promotes growth. CRB can burrow under or through most tarps. Use this method for mulch, finished compost).

Netting: Netting can entangle and prevent CRB from accessing or escaping the crown of the tree, decaying palm stumps, and piles of high-risk material. Use this method for tree and palm waste, mulch, finished compost, soil or potting media, non-woody plant waste, and crowns of living palms.

Note: Gill netting with this size mesh is not legal for use near water areas or for fishing. It is also not legal to sell in Hawai'i (HAR 13-75).

Pesticides: Pesticides are applied as sprays, granules, systemic injections, or systemic root drench. Since systemic pesticides require CRB to feed on the plant to die, damage will still occur but will be reduced when there is a reduction in the local CRB population. Can be used on live host plants, tree and palm waste, mulch, finished compost, and soil or potting media.

Note: When applying systemic pesticides to trees, remove palm flowers and fruits before treatment and every 6 months during treatment to safeguard pollinators and prevent human exposure. Consult the product label for legal application sites.

- **Injection:** Imidacloprid (e.g. ImaJet) and Acephate (e.g. AceJet) kill CRB in lab trials and have reduced populations when applied to most palms in a broad area.
- **Soil drench:** Imidacloprid (e.g. Imidacloprid 75 WSP) can be applied as a soil drench for systemic treatment of palms. Fully trimmed palms can be treated as "shrubs" when consulting the label for application instructions.
- **Foliar spray:** Spraying of palm crowns with pyrethrin (e.g. Oneguard, MustangMaxx, Evergreen, Demon Max) has been shown to kill CRB in the lab and field.
- **Breeding material:** Granules and sprays containing pyrethrins, may be applied to mulch, soil, and waste in some cases. This may require the area to be planted or near a structure.

METHODS FOR CRB CONTROL

Treatments for CRB

Kills all CRB in material	Tree/Palm waste branches, logs, stumps, fronds, leaves	Mulch chipped wood, sawdust, chopped plant material	Finished compost plant material composted and cooled to under 120 F	Soil any planting media that contains organic material, like peat, coir, wood chips, compost, or humus.	Non-woody plant waste grass clippings, leaves, vegetables, fruits
Chipping	☑				
Hot composting		☑			☑
Submersion			☑	☑	
Steam	☑	☑	☑	☑	☑
Fumigation	☑	☑	☑	☑	☑

Slows population growth	Tree or palm waste branches, logs, stumps, fronds, leaves	Mulch chipped wood, sawdust, chopped plant material	Finished compost plant material composted and cooled to under 120 F	Soil any planting media that contains organic material, like peat, coir, wood chips, compost, or humus.	Non-woody plant waste grass clippings, leaves, vegetables, fruits	Living host plant palms, hala, sugarcane, banana, etc.
Grind	☑					
Bury		☑	☑	☑	☑	
Till in		☑	☑	☑		
Spread thin		☑	☑	☑		
Tarp		☑	☑	☑	☑	
Net	☑	☑	☑	☑	☑	☑
Pesticides	☑	☑	☑	☑		☑

Department of Agriculture
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CRB MANAGEMENT TOOLS

What to do with CRB specimens for identification and disposal

If you've found or collected live CRB from traps, breeding sites, or trees, it's crucial to prevent their escape. Securely store them in a container such as a glass jar, 5-gallon bucket, or metal can with a lid. CRBs can escape from bags, thin plastic cups, tarps, thin wood, and most types of cloth.

If you are on an **uninfested** island or in an area where CRBs have not been found, please keep them in a sturdy container until identification is verified and reported. Take clear photos of both the top and bottom of larvae and beetles, including a ruler for scale. Clean dirt off larvae before taking photos. Additionally, take a short video of the larvae crawling on a flat surface. Report to 643PEST.org or call (808) 643-PEST (7378).

If you are on an **infested** island or an area where CRB are common, killing and disposal is recommended. See below for suggestions. If you are opposed to killing CRB, please keep them contained for the remainder of their life or turn them in to your local CRB authority.

CRB specimens can be killed by a number of methods. Below we present several that are common and cause minimal distress.

- Place in a sturdy plastic or glass jar and freeze for 24 hours or more.
- Pour 1-2 tablespoons of ⩾90% isopropanol, acetone, or ethyl acetate into a jar and seal the CRB inside for 24 hours or more.

- Submerge them in one of the household chemicals below:
  - ⩾70% Alcohol (isopropanol or ethanol)
  - ⩾10% Bleach solution (1:10 dilution of household bleach)
  - Household ammonia

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No ke noi ‘ana i kōkua māhele a unuhi ‘ōlelo, a me nā lawelawe a kōkua keu o kēlā ‘ano kēia ‘ano e pili ana i kēia palapala, e kelepona aku i ke ke‘ena o ka Luna Ho‘okele o ka HDOA ma (808) 973-9560 a i ‘ole e leka uila aku iā hdoa.info@hawaii.gov.

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