GUIDE FOR INTEGRATED PEST IDENTIFICATION AND MANAGEMENT IN PINEAPPLE

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**Foreword**

FUNDACIÓN PROAGROIN, through its Research and Development area, undertakes research projects in order to provide sustainable plantation management alternatives to its beneficiary growers.

The GEF-REPCar project arose at the initiative of the United National Environment Programme (UNEP), through funds from GEF (Global Environment Facility), and with the support of MINAET as National Coordinator, to foster Reducing Pesticide Runoff to the Caribbean See (REPCar). Demonstration plots were developed simultaneously in Costa Rica, Nicaragua and Colombia.

In Costa Rica, pineapple (*Ananas comosus*) is one of the main export crops and the last MAG census reports over 45,000 hectares throughout the country. Approximately 50% of the total area planted with pineapple is concentrated in the Huetar Norte Region, which encompasses more than 90% of the small and medium pineapple growers. All its rivers flow to the Caribbean Sea through the San Juan River. For this reason, the project was implemented in an input-intensive zone of direct impact, focusing on reducing the use of pesticides and applying Integrated Pest Management (IPM) principles to the most important phytosanitary problems faced by growers, with the support of Fundación PROAGROIN.

This document offers alternatives to manage the most significant pineapple pests and diseases, additionally providing tools to producers for the rational use of pesticides with the least environmental, social and economic impact.
Introduction

The Integrated Pest Management (IPM) strategy is based on integrating the different existing techniques (physical, mechanical, chemical, biological, genetic, legal, cultural, etc.) to control a pest, thus optimizing the use of pesticides and minimizing their impact on the environment and on human health.

The information provided herein results from several research efforts undertaken before and during this project and from experiences gathered from organic production projects, where the use of agrochemicals is limited.

Pests were identified on insects at different life stages, sampled in the field or captured and raised from early stages until adulthood. In the case of diseases, photographs of visible symptoms were taken in the field.

Taxonomic information was taken from existing literature, and the descriptions of damage and integrated management are the result of technical experiences at the Production and Research Departments of the Fundación.

Since this is a basic IPM guide for the principal phytosanitary problems on pineapple, it must be adapted accordingly to the conditions and characteristics of each farm. Before making changes to the phytosanitary handling of plantations, these changes should be validated through small-scales tests.

It is also worth remembering that chemical control is the last resort in IPM. Before applying any of the chemical molecules mentioned in this document, it is necessary to examine the list of products allowed on pineapple by the Ministry of Agriculture and Livestock, respect the re-entry periods and crop intervals as indicated in the product pamphlets, and consult your Agronomist.
Mealy Bug

Identification:

Description/Damage:

Mealy bugs are only mobile in early stages. They spread through the plant until they establish, for further development. Although no direct damage to the fruit is caused, it cannot be exported due to quarantine restrictions in other countries.
Integrated Pest Management (IPM)

IPM for mealy bugs begins with land selection. Tillable land that has been subject to several production cycles is more prone to pest problems, so verification and control methods must be more intense.

The selected seed stock must be free of any pest history and requires prior monitoring. Once the suckers are removed, seeds are dried for at least two days upside down on the seed bed (sun-based physical control).

Before planting, the seed must be cured by immersion in insecticide solutions, for example a diazinon base (300 ml. of commercial product/drum of water), or botanical extracts (400 ml/drum of water) in organic agriculture.

Taxonomy

Kingdom: Animal
Phylum: Arthropod
Class: Insect
Order: Hemiptera (Homoptera)
Family: Pseudococcidae
Genus: Dysmicoccus
Species: brevipes - (Cockerell)

Life Cycle
Mealy Bug

Once sown, the plantation must be kept clear of weeds and all alleys adequately managed, either through chopping or with herbicides. The presence of ants in alleys is monitored putting tuna in small open containers. If required, ant infestations are treated with such products as hydramethylnon or sodium octaborate, both of which must be protected against rainwater.

The most critical period is between weeks six and twelve, when the pineapple “eyes” are open to pests.

If the mealy bug persists, other insecticides with a lesser impact can be used, like potassium salt soaps or botanical extracts; or synthetic pesticides like diazinon, chlorpyrifos and ethoprophos at the time and dose recommended by the Agronomist.

Figure 3: Symbiotic relationship between the mealy bug and the ant. The ant provides transportation and protection in exchange for the honeydew present in its exudates.

Figure 4: Ants transporting ant bait
Fruit Borer

Identification:

Taxonomy

Kingdom: Animal
Phylum: Arthropod
Class: Insect
Order: Lepidoptera
Family: Lycaenidae
Genus: Strymon
Species: basilides - (Geyer)

Life Cycle

Figure 5: Life cycle of the Fruit Borer
Fruit Borer

**Description/Damage:**

The fruit borer larvae open galleries in the pulp, producing an oozing called “gummosis” on the outer side of the fruit. Insect damage leads to product rejection at the packing plant.

*Figure 6: Damage by the Fruit Borer*

**Integrated Pest Management (IPM)**

Fruit Borer IPM begins prior to establishing the plantation. Land with forest influence is more prone to this pest.

After forcing (flowering), the fruit should be covered with red or greyish bags impregnated with an adjuvant along the plantation perimeter to trap adults.

The critical period for pest attack is between weeks 7 and 13 after forcing, so applications and monitoring at this time must be intensified.
Biological control has given excellent results combating borer larvae, namely BT bacteria (*Bacillus thurigiensis*), *kurstaki* strain. This organism only acts through intake, so it should be used preventively, before larvae emerge.

It is important to alternate diazinon- and carbaryl-based chemical products, considering that both act by contact. Other molecules like chlorpyrifos or lambda-cyhalothrin have worked well against this pest. Once again, the use of agrochemicals should be a last resort in IPM, and must be recommended by an Agronomist.

*Figure 7: Ethological control of the Fruit Borer*
Sugarcane Midget

Identification:

Description/Damage:
The larvae basically scrape the surface of the fruit, producing a translucent colouring of the pulp and, frequently, external “gummosis.” Such damage or lesion causes the fruit to be rejected at the packing plant, rendering it useless for export.

Figure 8: Life cycle of the sugarcane midget

Figure 9: Damage caused by the sugarcane midget
Integrated Pest Management (IPM)

As with the fruit borer, land influenced by forests or mountains favours pest incidence. Likewise, adjuvant-impregnated red or greyish bags are used to trap adult insects along the plantation boundaries after forcing.

Critical attack periods range between weeks 11 and 17 after forcing, so applications and monitoring must be intensified at that time.

Biological control has produced excellent results in combating this pest, namely the aizawai strain of Bacillus thurigiensis, without forgetting the importance of preventive applications to ensure intake by larvae during juvenile stages.

Taxonomy

Kingdom: Animal
Phylum: Arthropod
Class: Insect
Order: Lepidoptera
Family: Noctuidae
Genus: Elaphria
Species: nucicolora - (Guenée)

Life Cycle
This may be alternated with chemical products based on diazinon, chlorpyrifos or lambda-cialothrin, as may be recommended by the Agronomist.
Black Spot Beetle

Identification:

Description/Damage:

Crop damage caused by *M. dimidiatipennis* occurs mostly during its larval stage, when it feeds principally from the roots and stem base; however, it also affects the peduncle, suckers and fruit.

**Taxonomy**

- **Kingdom:** Animal
- **Phylum:** Arthropod
- **Class:** Insect
- **Order:** Coleoptera
- **Family:** Curculionidae
- **Genus:** Metamasius
- **Species:** *dimidiatipennis* - (Champion, G.C.)

**Life Cycle**

![Figure 11: Life Cycle of the Black Spot Beetle](image)
Black Spot Beetle

Figure 12: Damage by the Black Spot Beetle

Integrated Pest Management (IPM)

Beetle IPM begins prior to establishing the plantation (prevention) to thus ensure good quality seed stock. Abandoned land put back into use is often not as profitable as land in full development. That is when beetles enter the production system, spreading through seedlings. Seeds must be cured through immersion in a pineapple-approved insecticide.
To confirm the presence of this pest, plantations are monitored using traps with pheromones and attractants (1/Ha). Additionally, this technique may become a mass adult trapping method by placing 4 to 6 traps/ Ha along the plantation borders.

Biological control with the *Beauveria bassiana*, fungus has given excellent results applied in large volumes of water (4000 L/Ha) and using a sun protectant (pinolene, vegetable oil).

In the event the previous techniques are not successful, diazinon, clorpyriphos, oxamyl or ethoprophos molecules in high volumes of water (4000 L/Ha) may be used, as recommended by the Agronomist. Monitoring is required to verify the effects of the insecticide on the beetle, and re-entry periods and intervals between application and harvest must be respected.

*Figure 13: Ethological control of the Black Spot Beetle*
Bacterial Rot

Identification/Damage:

According to author Bartholomew (2003), *Erwinia sp* is a facultative anaerobic bacteria. Damage is characterized by an aqueous lesion that begins on the white portion of the leaf base and moves in the form of an olive green blister. *Erwinia* is borne by wind, mist and insects such as ants. Plants are most susceptible at the ages of 4 to 8 months. Erwinia has occasionally appeared in the flower-fruit stage.

**Figure 14:** Identification of damage by Bacterial Rot
Integrated Pest Management (IPM)

The IPM of rots begins prior to establishing the plantation, selecting stagnant-free lands and adequately preparing the land. Drainage ditches need adequate designs and depths to evacuate excess humidity.

Figure 15: Management of drains for the control of diseases.

Taxonomy

Kingdom: *Animal*
Phylum: *Proteobacteria*
Class: *Schizomycetes*
Order: *Eubacteriales*
Family: *Enterobacteriaceae*
Genus: *Erwinia*

Microscopic View of the bacteria

Source: Tropical Agronomy
Bacterial Rot

Disease-free brood stock must be carefully selected before sowing, and seeds must be cured in bactericides.

If rot-affected plants appear within the first 30 days, larger seeds can be used for re-planting so that the plantation can even out over time.

Biological control of this rot has been excellent using the Trichoderma fungus and/or detritivore micro-organisms. Other products with a lesser impact include citrus seed extract, quaternary ammonium, and copper sulphate products.

It is important to alternate with chemical products based on fosetyl-Al, mancozeb, metalaxyl, carbendazime and others approved for pineapple.

Figure 16: Trichoderma
Fungal Rot

Identification/Damage:

According to Py (1969), *Phytophthora* sp infestation usually begins at the heart of the rosette, transported by sliding or splashing water. This fungus may cause significant damage in poorly drained soils and, therefore, with insufficient ability to absorb the amount of rainfall, especially in the case of calcium-rich soils. This disease (different species) also attacks roots, especially in early development phases (Jiménez, 1999).

**Taxonomy**

**Kingdom:** Fungi *(o Stramenopila)*

**Phylum:** Oomycota

**Class:** Oomycetes

**Order:** Peronosporales

**Family:** Pythiaceae

**Genus:** Phytophthora

**Microscopic View of the fungus**

Source: VBI Microbial Database
Fungal Rot

Integrated Pest Management (IPM)

As explained previously, rot-related IPM begins prior to establishing the plantation, by selecting areas free of stagnant waters and preparing the land adequately. Additionally, drainage systems must be carefully designed, with the adequate depth to move excess moisture.

Prior to planting, healthy materials should be selected and seeds must dipped into fungicidal products to ensure a better coating.

If plants exhibit rot symptoms in the first thirty days of planting, replanting with larger fruit is the option.

Fosetyl-aluminum, mancozeb, methalaxyl and carbendazime based chemicals as well as other approved products may be used on the crop.
Figure 17: Seed submerged in cure to prevent diseases.
Chinese Violet

**Kingdom:** Plantae  
**Phylum:** Tracheophyta  
**Class:** Magnoliopsida  
**Order:** Scrophulariales  
**Family:** Acanthaceae  
**Genus:** Asystasia  
**Species:** gangetica - *T. Anderson*

Itch grass

**Kingdom:** Plantae  
**Phylum:** Tracheophyta  
**Class:** Liliopsida  
**Order:** Poales  
**Family:** Poaceae  
**Genus:** Rottboellia  
**Species:** conchinchinensis – *(Lour)*

Turkey Berry

**Kingdom:** Plantae  
**Phylum:** Tracheophyta  
**Class:** Magnoliopsida  
**Order:** Solanales  
**Family:** Solanaceae  
**Genus:** Solanum  
**Species:** torvum - *(Swartz)*
**Catclaw Mimosa**
- **Kingdom:** Plantae
- **Phylum:** Tracheophyta
- **Class:** Magnoliopsida
- **Order:** Fabales
- **Family:** Mimosaceae
- **Genus:** Mimosa
- **Species:** pigra - L

**Broad-Leaved Button Weed**
- **Kingdom:** Plantae
- **Phylum:** Tracheophyta
- **Class:** Liliopsida
- **Order:** Rubiales
- **Family:** Rubiaceae
- **Genus:** Spermacoce
- **Species:** latifolia - Aubl

**Crabgrass**
- **Kingdom:** Plantae
- **Phylum:** Tracheophyta
- **Class:** Liliopsida
- **Order:** Poales
- **Family:** Poaceae
- **Genus:** Digitaria
- **Species:** sanguinalis – (Linnaeus)
Weeds

Description/Damage:
Pineapples with crowns that show the presence of quarantine weed and similar seeds will not be accepted for export, regardless of their destination, pursuant to the zero tolerance of the Government Phytosanitary Service (SFE).

Figure 25: Presence of weeds quarantined on a pineapple plantation.
**Integrated Pest Management (IPM)**

Weed IPM begins from the time the land is selected. Previous grazing land is more prone to weeds than former scrublands, so a more intense control is required.

The seed stock selected must have no history of quarantine weed problems.

Prior to sowing, land should be treated with pre-emergence herbicides (Ametryn and/or Diuron), as recommended by the technician. These should preferably be applied 10 days in advance, as a “seal,” without penetrating the soil. Another alternative is to use adequate plastic cover.

All equipment used to prepare the ground should be carefully washed before entering a new area to prevent spreading any weeds. Access of persons and machinery must be regulated throughout the productive cycle.

After planting, the area must be kept free of weeds and alleys must be managed appropriately, either with chopping or with herbicides. If chopping, weeds should grow no taller than the pineapple plants and must certainly not be allowed to flower. Weeds in reproduction must be manually eliminated and
immediately placed in bags or sacks, since the herbicide may favour seed ripening.

The critical period begins 24 weeks prior to harvest, when plantation boundaries, seedbeds, alleys, neighbouring areas, buffer zones and drainage ditches must be kept free of weeds.

Figure 26: Manual control of weeds (weeding)
Bibliography


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