Agriculture Technology

Pests of Palm Oil:
Steering towards eco-friendly management solutions

Amidst the lush greenery of Malaysia's heartlands, oil palms stand tall as sentinels of prosperity, anchoring an industry that weaves through the nation's economy. Yet, this agricultural miracle face a silent war against an array of minuscule adversaries—pests that threaten not just yields but the very sustainability of the oil palm legacy. Understanding these challenges and pioneering effective solutions isn't just an agricultural prerogative; it's a matter of national urgency.

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XERAYA CAPITAL
Life Venture

Malaysia’s green gold - The export of 24.72 million tons of palm oil and its derivatives in 2022 alone generated a substantial revenue of RM137.89 billion to the country

Oil palm is a highly significant agricultural crop that plays a vital role in the Malaysian economy, accounting for a staggering 5.67 million hectares or more than 75% of the country's agricultural land. However, like other crops, oil palm is susceptible to pest attacks that can diminish yields significantly. Therefore, understanding these challenges and implementing effective solutions is crucial for minimizing losses and ensuring the long-term sustainability of this vital industry. There are numerous pests that threaten the productivity of oil palm plantations to varying degrees; some pests lead to yield losses, and some can cause palm death. Despite the numerous pests, most species have been studied and effective control methods have been established to control these populations.

Often, pest control comes in the form of chemical intervention. The use of chemicals, though effective, raises environmental concerns due to potential harm to non-target species and overall environmental toxicity. This delicate balance requires a shift toward sustainable practices that ensure pest management without compromising the overall health of the ecosystem. Here in this article, we will discuss the major pest of oil palms, the destruction cost and ways to manage it. Clearly all these solutions need further innovation to increase the productivity while become more sustainable towards the environment.

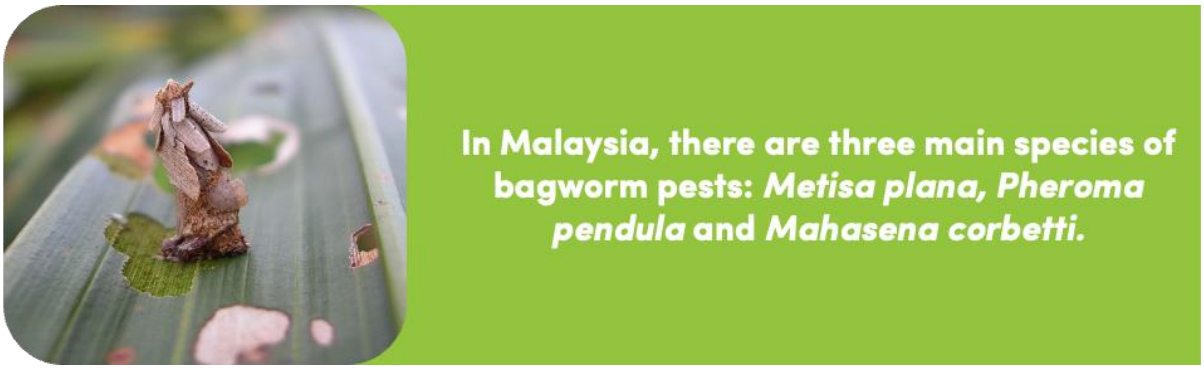
1. RHINOCEROS BEETLES

The rhinoceros beetle, *Oryctes rhinoceros,* poses a significant threat to oil palm plantations. As a borer, the adult tunnels into the meristematic tissues of shoots, causing substantial damage to the growing point of the plant. These wounds can lead to secondary infection and rotting, amplifying the damage caused by these beetles. This beetle is particularly lethal to young palms and causes an average crop loss between 40-92% in the first year of harvesting. It's essential to note that *O. rhinoceros* is not limited to oil palm infestations but also inflicts considerable damage on other palmae tree such as coconut. Population outbreaks are common in areas of replanting, where decomposing oil palm trunks from felled trees serve as breeding sites. Studies have shown that burning the site does not mitigate infestations, and should not be practiced as it harms the environment without effectively stopping the beetles.

The conventional method control commonly used is the deployment of pheromone traps. These traps utilize the chemical compound ethyl 4-methyloctanoate, the main male-produced aggregation pheromone in *O. rhinoceros*. The pheromone is placed in a contraption or "trap," typically constructed 3 meters above the ground and includes a pheromone dispenser at its center and a collection bucket below to gather fallen individuals. While the trap tends to attract more females than males, and nearly all females are gravid, it proves highly effective in controlling population levels, up to two hectares is covered per trap, and reducing pest populations in the next generation.

Another method of control involves the use of the soil fungus *Metarhizium anisopliae*, which targets mainly the larvae of this species and induces mortality within a week. In severe cases, chemical control is an option. Contact insecticide from pyrethroid group can be sprayed onto the crown and spear of immature plants, which has proven effective. However, considering the potential harm of chemicals to the environment, this approach should only be employed in severe cases where the attacks of beetle exceed the threshold level at 5% damage of oil palms in the field.

2. MAJOR LEAF-EATING INSECTS



The major leaf-eating insect pests in oil palm plantations are bagworms and Nettle caterpillars. Bagworm and Nettle caterpillars are both from the order Lepidoptera. The outbreak of the pests can lead to significant losses in yield, up to 10-50% yield loss at 50% defoliation of canopy. The control methods typically involve the use of chemical insecticides applied either through foliar spraying for active ingredients with contact effect, or trunk injection for active ingredients with systemic effect. Active ingredients like pyrethroid and neonicotinoid insecticides have demonstrated effective bagworm population control in a single round of application.

Alternatively, bio-insecticides like *Bacillus thuringiensis* (Bti) are also available for spraying, although their efficacy is not as high as the aforementioned chemical active ingredients. However, it's important to note that while chemicals are more effective at eliminating pests, they also harm beneficial insects such as the oil palm pollinator weevil, *Elaeidobius kamerunicus*. On the other hand, its subspecies, *kurstaki* (Btk), although less effective against bagworms, does not pose a threat to pollinators. This creates a trade-off when deciding which chemical method to use. Another alternative method for controlling leaf-eating caterpillars is to rely on its natural enemies as a biological control agent. Beneficial insects such as *Brachymeria carinata*, *Spinaria spinator* and *Dolichogenidea metesae* can lay eggs inside caterpillars, leading to infections in pest populations of up to 70% in some cases. Plantations

can encourage the presence of these parasitoids by planting flowering plants like *Cassia cobanensis*, *Turnera* sp. and *Antigonon* leptopus.

A more sustainable approach to control aims to rely more on biological methods while minimizing the use of chemicals. Regular and targeted pest population census surveys based on the life-cycle knowledge of the leaf-eating caterpillars can assist planters in making effective and sustainable control efforts.

These leaf-eating insects causes up to 10-50% yield loss at 50% defoliation of canopy. Active ingredients such as pyrethroid and neonicotinoids are effective management solutions for these pests.

3. TERMITES

Coptotermes curvignathus **poses the most serious threat to oil palms, particularly in oil palms grown in peat soil. This species causes death by consuming the meristem tissue or vascular system of oil palm tree.**

Being a tropical country, Malaysia boasts a high species richness of termites. While termites inherently play various beneficial roles in ecosystems such as decomposers and nutrient cyclers, some species are deemed pests in the oil palm agricultural system, causing significant harm. Termite management in oil palm plantations primarily depends on termiticide application and termite baiting system. Termiticides like fipronil and imidacloprid are applied through spraying, forming a protective barrier that shields oil palm trees from termite activity and potential damage. However, it is crucial to consider the environmental risks associated with open spraying, including contamination and impacts on non-target organisms.

In contrast, termite baiting systems in oil palm plantations provide a targeted and eco-friendly solution. Strategically placed bait stations, containing slow-acting toxicants like chlorfluazuron and hexaflumuron, ensure colony elimination as termites carry the bait back. Although area-wide management via termite baiting is slower, its sustainable nature is advantageous in the long run.

Regular monitoring and maintenance enhance efficacy, while minimizing environmental impact by reducing the reliance on broad-spectrum chemicals. This integrated approach promotes sustainable and environmentally conscious termite control in oil palm cultivation.

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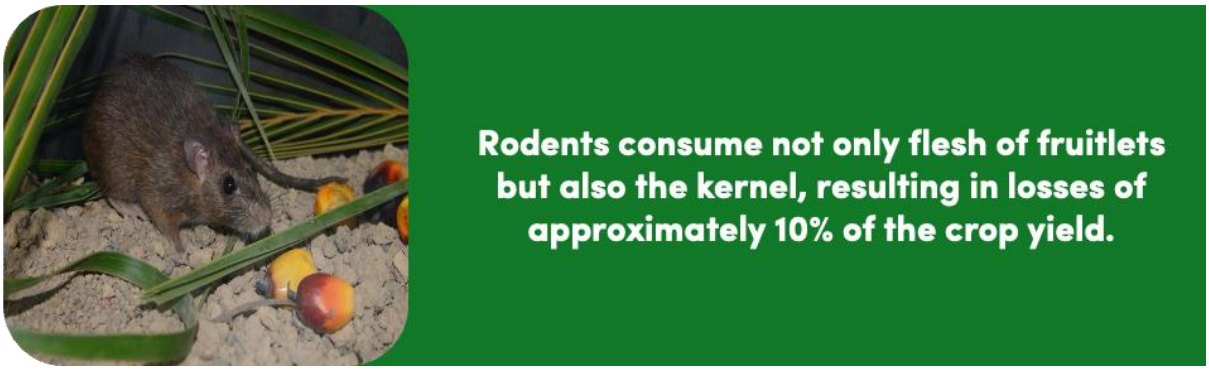
4. RODENTS



Rodents, particularly rats, pose a significant threat to oil palm plantations. Damage by rats on oil palm is inflicted throughout the growth of the palm regardless of age, leading to losses of seedlings through attack in nurseries, damage of newly planted palms, and in mature planting, damage to inflorescences and fruit, causing severe loss in oil yield Additionally, rats consume not only the flesh of fruitlets known as mesocarp but also the kernel, resulting in losses of approximately 10% of the crop yield. In Malaysia, three species deserve mentioning: *Rattus tiomanicus*, *R. argentiventer*, and *R. rattus diardii*. However, the composition of these species varies based on specific oil palm habitat structures, such as palm age and location. Rats exhibit diverse behaviours, including arboreality and burrowing, allowing them to inhabit various habitats within the plantation.

Notable biological control agent such as the barn owls (*Tyto javanica javanica*) for rat control are drawing significant interest due to its remarkable adaptation to oil palm plantations. Thriving on a diet primarily consisting of 98% rats, this owl species plays a crucial role in rat management. Other predator species, including disturbance-tolerant animals such as leopard cats, palm civets, Asian water monitor lizards and various snake species also contribute to rodent control. While the proportions of rats in the diets of these predators may vary, the combined efforts of the predator community create a resilient system capable of utilizing abundant prey rat populations.

Despite the seemingly effective biological method for rat control, rat populations may, at times, experience explosive growth, leading to severe damage and losses. In such instances, chemical control becomes necessary. The attributes of rodenticide such as effective result with quick reduction in pest numbers and convenience of use has made them a popular method to deal with rat problem in oil palm plantations. Rodent chemical control typically employs anticoagulant rodenticides, available in two general forms: first- and second-generation. Historically, first-generation rodenticides like Warfarin have been in use for decades, and are known for being less toxic as they require higher doses to induce mortality.

However, due to extensive use, many rat populations have developed resistance to this compound. On the other hand, second-generation compounds such as brodifacoum and bromadiolone are more toxic and face lower resistance levels compared to Warfarin. Yet, a crucial trade-off must be considered – second-generation compounds take longer to decay, posing a threat to non-target species like barn owls and other scavengers if they consume weakened or dead rats. Therefore, the widespread use of second-generation rodenticides is not recommended due to its severe ecological consequences. In cases where rodenticide becomes necessary, a strategic approach is essential.

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STEERING TOWARDS SUSTAINABLE STRATEGIES

The diverse challenges posed by pests in Malaysian oil palm plantations necessitate a well-balanced and sustainable strategy for long-term pest population control. While chemical interventions prove effective, their ecological implications underscore the importance of considering non-chemical alternatives. Biological methods by encouraging the presence of natural predators of the pests present viable solutions. Regular censuses are crucial for continuously assessing pest populations and outbreak areas, enabling the effective implementation of control strategies where necessary.

As we stand at the crossroads of agricultural advancement and environmental stewardship, the way forward demands innovation and adaptability. The pest management strategies we adopt today will echo through the corridors of Malaysia's agricultural legacy, posing a profound question: How will we reconcile the immediate demands of production with the long-term imperatives of ecological balance?

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