

# Revolutionising Conventional Oil Palm Practices with Drone Technology

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## INTRODUCTION

Drone technology has become increasingly prevalent in the agriculture industry due in recent years continuous advancements in the field. The technology has brought significant breakthrough in mechanisation, particularly in oil palm plantations, where many plantation companies seek to modernise their agricultural practices. The integration of drone operations in agriculture offered numerous benefits, including promotion of evidence-based decision-making, data-driven operations to optimise efficiency and productivity, and reduced potential exposure to hazardous chemicals. In this article, we will explore the benefits of drone technology in the oil palm and agriculture sector and its impact it has on sustainability and profitability.

## DRONE VS CONVENTIONAL METHOD

In 2020, the global COVID-19 pandemic had significantly impacted the agriculture sector, with Malaysia experienced a loss of approximately RM4.5 billion (Parveez *et al.*, 2022). The pandemic also caused crude palm oil (CPO) prices to surge to nearly RM10 000 t<sup>-1</sup> due to border restrictions and lockdowns that prevented plantation companies from hiring foreign labour to work in their estates. This surge in prices adversely affected critical activities such as harvesting, crop protection, fertiliser application, and farm maintenance.

The century-old palm oil industry in Malaysia was facing severe labour shortage, with only around 32 000 foreign employees present in 2022. This shortage was compounded by the disinterest of Malaysians in physical labor work, particularly among younger generations

living in urban areas. This lack of interest, along with limited exposure and understanding of the importance of agriculture, and the perception that it is not a lucrative career option, posed a significant threat to Malaysia's efforts to increase earnings by RM20 billion. Projected CPO production is estimated to decline by approximately 20% to 30% during 2022-2023.

Drone technology can be utilised in the oil palm industry to tackle the problem of dependency on foreign labour. Drone technology involves the use of unmanned aerial vehicles (UAVs) equipped with various sensors and imaging equipment to collect data and perform tasks. This is in contrast to conventional oil palm practices that typically involved manual physical labour, manual visual inspection, and traditional farming techniques for managing oil palm plantations. By incorporating UAVs into agricultural work, tech-savvy companies in the agriculture industry can reap massive benefits in terms of productivity and revenue.

The use of drones in the oil palm industry is an exciting development that has shown great potential in crop protection activities. Moreover, ongoing research and development efforts focused on employing drones for harvesting purposes, and initial attempts, such as the use of laser technology to harvest fruit bunches, have shown promising results. With continued investment and advancements in drone technology, drones is expected to become an essential tool in commercial oil palm operations in the near future. The incorporation of UAVs into the industry could lead to increased productivity, efficiency, and cost savings, while also addressing labour shortages and reducing environmental impact.

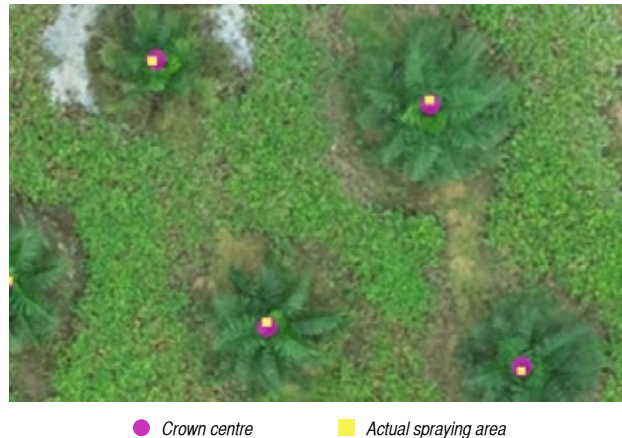
### ROBUSTNESS AND PRECISION

Robustness and precision of crop management are two critical factors determining the success and sustainability of plantation management in the oil palm industry. To ensure efficient operations and maximise yields, it is essential to adopt tools and techniques that can provide consistent, accurate, and reliable results. Although, human labour has been an essential component of agriculture for centuries, its inherent weaknesses have made it less effective in modern-day practices.

Drone technology has made significant advancements in recent years, especially in the oil palm industry. Drones can be programmed to adapt to different needs and requirements, such as crops monitoring, mapping, planting, and spraying. They can also be utilised for data captured, using artificial intelligence (AI) technology and big data analytics to enable data-driven decision-making. Various types of drones are utilised for plantation operations, such as mapping, monitoring, crop protection, and fertilisation. The incorporation of AI has resulted in improved productivity and efficiency, decreasing processing time and allowing for larger areas to be covered.

An excellent example of drone technology in the oil palm industry is the use of drones for crop protection against rhinoceros beetles. To protect immature oil palm trees against these beetles, plantation owners commonly used crop protection services that utilise drone technology. The targeted application of chemicals at the crown centre of the palm (*Figure 1*), where new shoots emerge, requires precision. By deploying drones, coupled with Real-Time Kinematic (RTK) technology, the chemical can be precisely applied with over 90% accuracy. The use of drones with RTK technology for chemical application thus offers a more effective and precise alternative to traditional manual methods.

The emergence of drone technology has opened up new possibilities for improving the robustness and precision of agricultural practices in the oil palm industry. Drones have the potential to provide a more consistent and accurate approach compared to traditional human labour. By adopting these new technologies and techniques, the oil palm industry can achieve greater productivity and sustainability, contributing to the advancement of the agriculture sector as a whole.



*Figure 1. The accuracy of spraying area.*

### PRODUCTIVITY AND EFFICIENCY

The demand for palm oil has led to increased focus on sustainable and efficient management practices in the oil palm industry. In the past, these tasks were performed manually, leading to several challenges such as safety hazards, time constraints, and reduced efficacy in managing pests and diseases. However, many big plantations have now migrated to using drone technology for crop protection services, such as managing the rhinoceros beetle, bagworm infestations, and pestalotiopsis.

Drone technology offers significant potential in improving efficiency and productivity in the oil palm industry, especially in challenging terrains. Drones can cover large areas in a relatively short time, making the process more efficient compared to manual labour. Drones offer several advantages, including access to hard-to-reach areas and the ability to cover larger area in a shorter amount of time.

In real-life operational experiences, it has found that drones are a productive and reliable solution that surpasses the performance of other estate equipment. A comparison of various methods for bagworm management per day (*Table 1*) showed that drone technology improved productivity by two-fold compared to human labour in terms of the time required to complete 1000 ha. The data also supported the use of drones as a reliable and rapid solution with minimal reliance on manual labour. Efficient management of oil palm plantations requires solutions that offer reliability and efficiency, and drone technology has shown the potential to meet these requirements in pest

**TABLE 1. PRODUCTIVITY COMPARISON BETWEEN APPLICATION METHODS FOR BAGWORM INFESTATIONS**

Method	Productivity/ day	Time to complete 1000 ha
1. Aerial Spray (Drone)	36 ha (1 team for 3 drones)	27 days
2. Trunk Injection	4-5 ha (1 team for 2 manpower)	200 working days (1 team)
3. Ground Spray using Maruyama MD180DX (Backpack Spray)	4-5 ha (1 manpower)	200 working days (1 manpower)
4. Ground Spray using MS 0735W (Backpack Spray)	3.3 ha (1 manpower)	303 working days (1 manpower)
5. Ground Spray using Jacto AJ401-LH Plus (Tractor-Mounted Cannon Sprayer)	9-11 ha (1-2 manpower)	91 working days (1 team)
6. Ground Spray using Jacto Arbus 400 Golden (Tractor-Mounted Air Blast Sprayer)	16-20 ha (1-2 manpower)	50 working days (1 team)

and disease control. The example represented significant benefits in terms of productivity and efficiency compared to human labour for oil palm plantations. Drones offer precision application capabilities, advanced sensors, and efficient data collection and analysis. With these features, drones have the potential to revolutionise the industry and improve sustainability, leading to better management practices and increased yields.

## CONCLUSION

Utilisation of drone technology in the oil palm industry has the potential to significantly transform traditional practices and bring about a revolution in the field. The precision and robustness of drone applications offer vast potential in enhancing monitoring, management, and overall efficiency and sustainability of cultivation. With responsible implementation, as well as environmental and social factors consideration, drone technology can pave the way towards a more sustainable and profitable

future for the oil palm industry. The incorporation of drones into agricultural practices will lead to increased precision, reduced cost, and significant reduction in the environmental impact of cultivation activities. As awareness of the benefits of drone technology spreads, the adoption of this innovative technology will accelerate, leading to further improvements in productivity and sustainability. The oil palm industry is poised to be at the forefront of this technological revolution, contributing to the advancement of the agriculture sector and leading the way towards a more prosperous and sustainable future.

## REFERENCES

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