APPLICATION OF DRONE TECHNOLOGY TO ASSESS NITROGEN STATUS IN OIL PALM (Elaeis guineensis Jacq.)

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APPLICATION OF DRONE TECHNOLOGY TO ASSESS NITROGEN STATUS IN OIL PALM (*Elaeis guineensis* Jacq.)

By

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CERTIFICATION

This project entitled "Application Of Drone Technology To Assess Nitrogen Status In Oil Palm (*Elaeis guineensis* Jacq.)" is prepared by Nurul Azmina binti Hashim and submitted to the Faculty of Agriculture in fulfillment of the requirements of PRT 4999 (Final Year Project) for the award of the degree of Bachelor of Horticultural Science.

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ABSTRACT

Drones, also known as unmanned aircraft vehicles (UAV), are pilotless aircraft that are controlled by computers or simple remote control. Recently, drones have been used in spraying operations over a wheat field in Xinghua, East China's Jiangsu province. The drone can be potentially used to detect the nutrient status of plants. *Elaeis guineensis* or commonly known as oil palm is the main industrial crop in Malaysia. The health and quality of oil palm need to be monitored frequently. Generally, nitrogen (N) status in plant plays a major role in crop productivity. The conventional assessment of N status is usually based on leaf and soil analysis which are highly costly and laborious. The capability of a drone is not fully explored for nutrient assessment in cropping systems. Its use to assess N status in oil palm is a plausible option to consider due to the large crop acreage and potential cost and time-saving. Therefore, the objective of this project is to assess the feasibility of using drone technology to assess N status in a young oil palm stand. This project is carried out at the commercial oil palm plantation in Negeri Sembilan and eBee MultiSPEC 4C is deployed as the drone equipment. For this project, 76 samples per ha are chosen and analysed for Normalized Difference Vegetative Index (NDVI), RGB, thermal imaging. Corresponding leaf and soil analysis are carried out. Both drone analysis and manual (leaf and soil) analysis are compared. Based on the result, there is significant correlation between nitrogen status in leaf and drone imagery indices over the study region.

ABSTRAK

Dron, juga dikenali sebagai pesawat tanpa pemandu (UAV), merupakan pesawat terbang tanpa pemandu dan kru yang dikawal melalui komputer atau alat kawalan jauh. Ladang gandum di Xinghua, wilayah Jiangsu, timur China telah menggunakan dron sebagai alat penyemburan. Selain itu, dron juga berpotensi mengenal pasti status nutrien dalam tumbuhan. *Elaeis guineensis* atau dikenali sebagai pokok kelapa sawit, merupakan tanaman industri yang utama di Malaysia. Oleh yang demikian, pokok kelapa sawit memerlukan pantauan secara kerap demi pokok yang sihat dan berkualiti. Secara amnya, status nitrogen (N) dalam tumbuhan memainkan peranan utama dalam produktiviti tumbuhan. Kebiasaannya, penilaian konvensional untuk menentukan status N dalam tumbuhan dilakukan melalui analisis daun dan juga tanah yang memerlukan kos yang tinggi serta tenaga pekerja yang banyak. Dron mempunyai kebolehan untuk mengesan status nutrien dalam tumbuhan tetapi masih belum diterokai sepenuhnya oleh masyarakat. Pengaplikasian dron dalam mengesan kandungan status N dalam kelapa sawit merupakan satu cara alternatif terkini yang boleh dipertimbangkan kegunaannya bersesuaian dengan keluasan ladang yang boleh menjimatkan kos dan masa. Oleh itu, objektif projek ini adalah untuk mengenal pasti kebolehan teknologi dron dalam mengenal pasti kandungan status N dalam pokok kelapa sawit. Projek ini dijalankan di sebuah ladang kelapa sawit komersial di Negeri Sembilan dengan menggunakan eBee MultiSPEC 4C dron sebagai alat kajian. Dalam projek ini, sebanyak 76 sampel per hektar dipilih dan dikaji untuk gambar "Normalized Difference Vegetative Index (NDVI)", RGB dan termal. Analisis daun dan tanah juga dijalankan. Keputusan kandungan status N dari kedua-dua analisis, dron dan manual (analisis daun dan tanah) dibandingkan. Berdasarkan keputusan, perkaitan antara

status nitrogen dari gambaran dron dan analisis daun dalam kawasan kajian adalah signifikan.

CHAPTER 1

1.0 INTRODUCTION

Oil palm (*Elaeis guineensis*) is a major industrial crop and also number one commodity crop in Malaysia. Malaysia is one of the countries that produce the most palm production and known as the world second-largest palm oil producer after Indonesia, which consists about 4.5 million of land used for oil palm plantation.

Oil palm, however, has high nutrient demand which causes significant problems faced by many oil palm commercial company regarding nutrient deficiency. The primary nutrient that requires oil palm plant is nitrogen as it is the first nutrient needed by oil palm in a growth process. However, many oil palm growers faced problem regarding the losses of nitrogen (N) in agroecosystems which contribute to significant environmental and economic issues.

As nitrogen is leaching into the environment, growers need to replace the number of nitrogen losses by adding fertilizer. This step is the only solution to restore nitrogen deficiency due to declines in the environment. Unfortunately, due to the prices of fertilizer, it had become a significant burden to oil palm plantation management as adding fertilizer to maintain the product's capacity of oil palm will overall increase the management cost. Hence, there is a need to improve and sustain oil palm production which several methods have used over the years.

One of the methods that can increase fertilizer application in oil palm field is by leaf and soil analysis which have been applied to determine the deficiency and sufficiency status of nutrients for oil palm for years. However, this method is time-consuming and cost-inefficient. Thus, remote sensing technology has been developing

and used in some oil palm's fields for a quicker and cost-efficient way to determine the deficiency and sufficiency status of nutrients. Remote sensing imagery integrated to a Global Positioning System (GPS) and Geographical Information System (GIS) which could obtain the Normalized Difference Vegetation Indices (NDVI) that is used to interpret data from the ground.

Recently, drone also known as an unmanned aerial vehicle (UAV) has been developing with high-quality sensors that can be used in interpreting ground imagery obtained by drone camera. Design with smaller in sizes yet compact with high technology sensor, these drones are the easiest way to create a topographic survey of a field compare to expensive, time-consuming and highly energy needed for traditional methods. Flying a drone only takes few minutes and 5-10 times faster than conventional methods for an accurate site imagery which also consist of NDVI data of the ground. These new drone technology help in persisting as well as sustaining oil palm production with effective total cost consuming in the field.

1.1 Study objective

The objective of this study is to assess the feasibility of using drone technology to evaluate N status in a young oil palm stand.

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