



**UNIVERSITI PUTRA MALAYSIA**

**NITROGEN AND POTASSIUM DEFICIENCY EFFECT ON GROWTH AND  
BASAL STEM ROT DISEASE SEVERITY OF OIL PALM SEEDLINGS  
PLANTED ON PEAT SOIL**

**NUR SYUHADA ABDUL WAHAB**

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**BY**

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**FACULTY OF AGRICULTURE**

**UNIVERSITI PUTRA MALAYSIA**

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## CERTIFICATION

This project report entitled Nitrogen and potassium deficiency effect on growth and basal stem rot disease severity of oil palm seedlings planted on peat soil” is prepared by Nur Syuhada Binti Abdul Wahab and submitted to the Faculty of Agriculture in fulfillment of the requirement of PRT4999 (Final Year Project) for the award of the degree of Bachelor of Agriculture Science.

Submitted by

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## ABSTRACT

Palm oil is the most commonly used vegetable oil, with around 45.3 million tons produced annually worldwide, it has many uses in several products including cosmetics, cleaning products, and also processed food. However, oil palm plantations in Malaysia have many disease problems, which cause the reduction of oil palm yield. The main diseases that often attack oil palm tree is basal stem rot (BSR), which is caused by the fungi called *Ganoderma boninense*. Diseased oil palm tree cannot survive long and cause the decrease in oil palm yield. Therefore, the objective of this study was to determine the effect of deficiency of nitrogen (N) and potassium (K) on the (i) growth and (ii) disease severity of oil palm seedlings infected by *Ganoderma boninense* planted on peat soil. The experiment was conducted in a randomized complete block design (RCBD) with six blocks (3 blocks inoculated with *Ganoderma boninense*, 3 blocks not inoculated with *Ganoderma boninense*) with each block having five replications. The treatments used were (i) deficiency, (ii) optimum, and (iii) control. The quantity of fertilizer differentiated by the deficiency (treatment 1), optimum (treatment 2), and control (treatment 3). The parameter measured included seedling height, bole diameter, number of fronds per seedling, disease severity, photosynthesis rate and relative chlorophyll content. The result obtained from this study showed that optimum (treatment 2) shows a very good growth compared to the other treatments although it was inoculated by *Ganoderma boninense* and the disease severity index was also lower compared to other treatments.

## ABSTRAK

*Kelapa sawit kini telah menjadi minyak sayur-sayuran yang paling biasa digunakan, dengan kira-kira 45.3 juta tan pengeluaran setiap tahun di seluruh dunia. Minyak ini mempunyai banyak kegunaan dalam beberapa produk termasuk kosmetik, produk bahan pencucian, dan juga makanan yang diproses. Walau bagaimanapun, ladang kelapa sawit di Malaysia mempunyai masalah penyakit yang menyebabkan pengurangan hasil kelapa sawit. Penyakit utama yang sering menyerang pokok kelapa sawit ialah reput batang (BSR) yang disebabkan oleh kulat yang dikenali sebagai *Ganoderma boninense*. Pokok sawit yang diserang oleh penyakit ini tidak dapat bertahan lama dan menyebabkan penurunan hasil. Oleh itu, objektif kajian ini adalah untuk menentukan kesan kekurangan nitrogen dan kalium pada (i) pertumbuhan dan (ii) keterukan penyakit anak benih kelapa sawit dijangkiti *Ganoderma boninense* ditanam di atas tanah gambut. Eksperimen ini dijalankan dalam reka bentuk blok lengkap rawak (RCBD) dengan enam blok (3 blok disuntik dengan *Ganoderma boninense*, 3 blok tidak disuntik dengan *Ganoderma boninense*) dengan setiap blok mempunyai lima replikasi. Rawatan yang digunakan ialah (i) kekurangan (ii) yang optimum dan (iii) kawalan. Kuantiti baja dibezakan oleh kekurangan (rawatan 1), optimum (rawatan 2), dan kawalan (rawatan 3). Parameter yang diukur termasuk ketinggian anak benih, diameter batang, jumlah pelepah setiap anak benih, keterukan penyakit, kadar fotosintesis dan kandungan klorofil dan relatif. Keputusan dijangka adalah kekurangan nitrogen dan baja kalium akan menyebabkan jangkitan yang lebih tinggi daripada *Ganoderma boninense*. Keputusan yang didapati daripada kajian ini menunjukkan bahawa kadar optimum (rawatan 2) menunjukkan pertumbuhan pokok yang baik berbanding rawatan lain walaupun ianya dijangkiti *ganoderma boninense* dan kadar optimum juga menunjukkan indeks keterukan penyakit yang rendah berbanding rawatan lain.*

## CHAPTER 1

### INTRODUCTION

#### 1.1 Oil palm in Malaysia and basal stem rot

Oil palm (*Elaeis guineensis*) originated plant from Africa, in particular of West Africa, where it grows in the wild and after that, it was developed into an agricultural crop. The oil palm in Malaysia is over a century old. This plant is introduced by the British as an ornamental plant in 1871, where the oil palm was commercially exploited as an oil crop only from the year 1911, when the first oil palm estate was established in Tennamaran Estate in Selangor. The cultivation of oil palm increased at a fast pace in early 1960s under the government's agricultural diversification programmer, which was introduced to reduce the country's economic dependence on rubber and tin. Later in the 1960s, the government introduced land settlement schemes for planting oil palm as a means to eradicate poverty for the landless farmers and smallholders. Nowadays, this plant is one of the most important crops in Malaysia that most commonly used as vegetable oil. The oil palm industry is the main pillars of the economy. One of the major disease damage in the oil palm plantation is a basal stem rot disease (BSR). This disease was recognized in Malaysia since 1928, when it attacks mainly palms above 30 years of ages. After year 1957, the infections at younger palm of 10-15 years become more apparent and followed by infections of the disease in oil palms at nursery stage. This disease also attacks immature palms. Total area of oil palm that are infested with this disease is increasing due to this reason, but until today there are no ways to address the disease effectively. Basal stem rot disease is spread by microscopic fungal spores produced

by the fruiting bodies. There is some factor that causes the increasing spread of this disease for example, poor drainage, flooding, nutrition imbalance and heavy weed growth.

According to Goh and Hardter (2003), the nutrients requirements of oil palm vary widely, and depend on so many factors, such as the target yield, the type of planting material used, palm spacing, palm age, soil type, groundcover conditions, as well as climate and other environmental factors. The macro-nutrients are very essential elements that required for normal plant growth and for oil palm, this group comprises the nutrients N, P, K, Mg, Ca, S, and Cl. Moreover, Goh and Hardter (2003) added that, all of the essential elements are intricately involved in physiological processes leading to the final economic product of the oil palm; the oil contained in the mesocarp and kernels of the fruits that contained in the fruit bunches. Nitrogen is commonly required for the rapid growth of young palms in the field. On the basis of N content, urea is found to be appreciably cheaper. Phosphorus is required on specific soils and often produces very large yield increases. On many soils, it may provide a further yield increment when K requirements are satisfied, but on its own it may actually reduce yields, possibly through the antagonistic effect on Ca content of the phosphatic fertilizers. Potassium is the most commonly required element for adult palms and with nursery or young palms it may reduce the incidence of leaf diseases, such as *Cercospora elaeidis*. It is usually applied as the chloride or sulphate according to availability and price.

*Ganoderma* is a white rot fungus. The organism causes economic loss of oil palm in various regions around the world including Southeast Asia (Corley and Tinker, 2003). The term “white rot” derives from the fungus degrading specifically the lignin component of wood while leaving white cellulose exposed (Paterson, 2006). The

BSR is a root diseases of oil palm which includes the infection on the basal stem. The roots and the affected basal stem are killed by fungal pathogen. Water and nutrient transport to the upper parts of the palms, especially the foliage, are severely restricted. The earliest visual symptoms occur on the canopy. Diseased palms thus, exhibit visual symptoms of frond wilting and malnutrition.

## 1.2 Objective

The objectives of this study were to determine the effect of deficiency of nitrogen and potassium on the (i) growth and (ii) disease severity of oil palm seedlings infected by *Ganoderma boninense* planted on peat soil.



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