UNIVERSITI PUTRA MALAYSIA

EXCESSIVE N AND K FERTILIZERS EFFECT ON GROWTH AND DISEASE SEVERITY OF BASAL STEM ROT OF OIL PALM SEEDLINGS GROWN ON PEAT SOIL

ABDULLAH WAFI MD ARIF

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ABDULLAH WAFI BIN MD ARIF

DEPARTMENT OF LAND MANAGEMENT

FACULTY OF AGRICULTURE

UNIVERSITI PUTRA MALAYSIA

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By

ABDULLAH WAFI BIN MD ARIF

A project report submitted to Faculty of Agriculture, Universiti Putra Malaysia, in fulfilment of the requirement of PRT 4999 (Final Year Project) for the award of the Degree of Bachelor of Agriculture Science

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This project report entitle “Excessive N and K Fertilizers Effect on Growth and Disease Severity of Basal Stem Rot of Oil Palm Seedlings Grown On Peat Soil” is prepared by Abdullah Wafi Bin Md Arif and submitted to Faculty of Agriculture in fulfilment of the requirement of PRT 4999 (Final Year Project) for the award of the degree of Bachelor of Agriculture Science.

Student’s name: Student’s signature:

ABDULLAH WAFI BIN MD ARIF .....

Certified by:

……

Prof. Dr. Mohamed Hanafi Musa
Project Supervisor
Department of Land Management
Faculty of Agriculture
Universiti Putra Malaysia.

Date: …….

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EXCESSIVE N AND K FERTILIZERS EFFECT ON GROWTH AND DISEASE SEVERITY OF BASAL STEM ROT OF OIL PALM SEEDLINGS GROWN ON PEAT SOIL

By

ABDULLAH WAFI BIN MD. ARIF

ABSTRACT

Oil palm (*Elaeis guineensis* Jacq.) is a main plantation crop in Malaysia. Basal stem rot disease (BSR) is one of the most serious disease that cause major losses in the oil palm plantation in South East Asia, especially in Malaysia and Indonesia. Basal stem rot is caused by white fungus called *Ganoderma*. Several species of *Ganoderma* have been reported and *Ganoderma boninense* is a well-known pathogen to oil palm. Oil palm is a high nutrient demanding crop. Application of N and K nutrients may promote growth and decrease disease severity. Therefore, the objectives of this study were to examine the effect of excessive N and K on growth and disease severity of oil palm seedlings grown on peat soil. The experiment was carried out in shade house at Ladang 2, Universiti Putra Malaysia. Three treatments and five replications with seven oil palm seedlings for each replication were used. The treatments were N and K optimum, N and K excessive and control treatment (NPK blue). For each treatment, half of oil palm seedlings were inoculated with *Ganoderma boninense*, whiles the other half was without *Ganoderma*. The experiment was arranged in randomized complete block design (RCBD). The parameters measured were total frond numbers, bole diameter, seedlings height, chlorophyll contents and basal stem rot disease severity by disease severity index of foliar (DSIF). The result showed difference patterns of growth for every treatment

from June until November (six month). Overall result showed that excessive N and K fertilizer gave an adverse effect on oil palm seedlings growth. Moreover, disease severity index of foliar result also showed that excessive N and K fertilizer have a high disease severity compared to other fertilizer treatments.

KESAN BAJA N DAN K YANG BERLEBIHAN TERHADAP PERTUMBUHAN DAN PENYAKIT REPUT PANGKAL BATANG ANAK BENIH KELAPA SAWIT YANG DITANAM DI TANAH GAMBUT

Oleh

ABDULLAH WAFI BIN MD. ARIF

ABSTRAK

Kelapa sawit *(Elaeis guineensis* Jacq.*)* merupakan tanaman industri utama di Malaysia. Penyakit reput pangkal batang (BSR) adalah salah satu penyakit utama menyerang tanaman kelapa sawit dan mengakibatkan kerugian besar kepada industri perladangan kelapa sawit di Asia Tenggara, khususnya Malaysia dan Indonesia. Penyakit BSR disebabkan oleh jangkitan kulat *Ganoderma*. Beberapa spesis kulat *Ganoderma* telah dikenalpasti dan kulat *Ganoderma boninense* adalah kulat yang berbahaya kepada tanaman kelapa sawit. Kelapa sawit adalah tanaman yang memerlukan keperluan nutrien yang tinggi untuk tumbesaran. Objektif utama kajian ini adalah untuk mengenalpasti kesan pembajaan N dan K yang berlebihan terhadap pertumbuhan dan penyakit BSR anak benih kelapa sawit yang ditanam di tanah gambut. Kajian ini telah dijalankan di rumah teduhan di Ladang 2, UPM. Tiga jenis pembajaan dilakukan dengan 5 replikasi dan 7 unit anak benih untuk setiap replikasi. Pembajaan yang digunakan adalah pembajaan NPK optimum, N dan K berlebihan dan juga NPK biru yang bertindak sebagai kawalan. Kajian ini telah dijalankan secara rekabentuk blok rawak lengkap (RCBD) dan tumbesaran anak benih kelapa sawit serta tahap BSR dikaji dan direkod. Hasil yang diperolehi menunjukkan perbezaan kadar pertumbuhan pada setiap bulan dari

bulan Jun hingga November (6 bulan) terhadap baja yang dibekalkan. Keputusan keseluruhan yang diperolehi telah menunjukkan baja N dan K berlebihan memberikan kadar pertumbuhan yang negatif dari keadaan pertumbuhan yang normal. Selain itu, baja N dan K berlebihan juga meningkatkan kadar tahap penyakit BSR.

CHAPTER 1

INTRODUCTION

The oil palm tree (*Elaeis guineensis* Jacq.) originates from West Africa, where it grows in the wild and later was developed into an agricultural crop. It was introduced to Malaysia, then Malaya, by the British in early 1870's as an ornamental plant. In 1917, the first commercial planting took place in Tennamaran Estate in Selangor. Nowadays, oil palm is the most important plantation crop in Malaysia.

The oil palm tree is a tropical plant, which commonly grows in temperate climates at altitude below 490 meters feet above sea level. Oil palm is normally monoceous; with both male and female flowers at the same tree. The oil palm yield can be harvested from 24 to 30 months after planting and continue to be productive up to 30 years. The oil palm can produce 8 to 15 fresh fruit bunches (FFB) per year weighing about 15 to 25 kg each, depending on the planting material and age of the palm.

However, infection with fungi has caused a decline in the productivity of oil palms and subsequently the palm oil industry, which created significant concern (Hartley, 1967; Turner, 1981). Basal stem rot (BSR) caused by the *Ganoderma boninense* fungus, is the major disease that attacked oil palm tree. This disease can affect the yield of oil palm and lead to death after infection. The worst part in oil palm plantation, which is this disease can be spread to another oil palm tree through root to root contact.

Most severe losses from BSR occur in Indonesia and Malaysia with lower incidences being recorded in Africa, Papua New Guinea and Thailand (Idris *et al.*, 2004). The BSR disease rate in 1994 was estimated at 1.51% (or 32 375 ha of affected areas from 2 144 080 ha of total matured areas) as published in the *MPOB Basal Stem Rot Census 1994-1995 report*. According to Roslan and Idris (2012), in 2009, BSR disease incidence rate was estimated at 3.71% (or 151 208 ha of affected areas from 4 705 702 ha of total matured area). Therefore, the yearly growth rate of area affected over the 15-years period was 10.3% per year. Assuming that oil palm plantation do not apply or give any treatment and the disease infection follow the same growth pattern, it was estimated that the total area affected by BSR in 2020 would be around 443 440 ha (65.6 million of palm trees).

The essential nutrients supplied to oil palm from nursery stage to matured oil palm are nitrogen (N), phosphorus (P), potassium (K) and Magnesium (Mg). In addition, boron (B) and in some nutrients, copper (Cu), zinc (Zn) and sulfur (S) are also essential for optimal growth. All these essential plant nutrients influence the health of plants and their susceptibility of oil palm to disease. Oil palm suffering from nutrient stress will be more susceptible to disease, while adequate nutrition makes it more resistant or tolerant to disease. Some nutrients have a greater impact on oil palm disease than others. Different oxidation forms of the same nutrients often have opposing effects on disease. This is true, mainly for N, S, Mn and Fe. Many experiments have been done to find the interaction between fertilizers and plant susceptibility to disease. However, in oil palm plantation, research on this interaction is very little and not widely explored compared with other crops such as rice.

As concern to this knowledge gap, the project was carried out in order to identify whether there is an effect of three types of different fertilizers applied to the oil palm seedlings on BSR disease severity.

Hence, the main objectives of this project were to observe the effect of excessive N and K fertilizer on (i) growth of oil palm seedlings and (ii) disease severity of oil palm seedlings that were inoculated with *Ganoderma boninense*.

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