GROWTH PERFORMANCE AND PHOTOCHEMICAL EFFICIENCY OF Magnolia elegans PLANTED IN RESTORATION AREA

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DEDICATION

Thanks to Allah S.W.T, who had given strength to complete this thesis.

Thanks to my beloved parent…

Mr. Azmin Bin Ariffin and Mrs. Noor Zarina Binti Ahmed Tajudin

My siblings…

Muhammad Ashraf Azimuallah, Muhammad Idzham Azimuallah, Siti Aisyah Azimuallah and the whole family

My supervisor

Associate Professor Dr Mohd Zaki Bin Hamzah

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Mr. Mohd Kamil Bin Ismail

Thanks for your support, encouragement and advice

All my precious friends

Thanks for your present in my life.

Thank you for your love, pray and support.

"Dedication and commitment are what transfer dreams into realities"

ABSTRACT

Magnolia elegans is a newly introduced species for forest plantation and has been trial-planted at high altitude at Terla B Forest Reserve, Cameron Highlands, as part of the restoration project. The main objective of this study was to determine the effect of environmental stress on the photochemical efficiency and growth performance of *M. elegans* at the restoration site (located approximately at 1320 m above sea level). The growth and photochemical efficiency parameters, such as height, diameter, chlorophyll content and chlorophyll fluorescence were taken. These data were then analysed by using General Linear Model and analysis of variance (ANOVA). The results showed that the species recorded low mean values in growth performances and chlorophyll content when exposed to low light intensity. On the other hand, the results on photochemical efficiency was not significantly difference between months of measurement. The recorded *Fv/Fm* value which ranged between 0.79 to 0.84 indicates that all the leaves of the planted species were under stress.

ABSTRAK

Magnolia elegans adalah spesies yang baru diperkenalkan untuk perladangan hutan yang telah ditanam di ketinggian tinggi di Rizab Hutan Terla B, Cameron Highlands, sebagai sebahagian daripada projek pemulihan. Objektif utama kajian ini adalah untuk menentukan kesan tekanan alam sekitar ke atas kecekapan fotokimia dan prestasi pertumbuhan *M. elegans* di tapak pemulihan (terletak lebih kurang 1320 m di atas paras laut). Parameter kecekapan pertumbuhan dan fotokimia, seperti ketinggian, diameter, kandungan klorofil dan pendarfluor klorofil telah diambil. Data ini dianalisis dengan menggunakan Model Linier Umum dan analisis varians (ANOVA). Hasil kajian menunjukkan bahawa spesies mencatat nilai min yang rendah dalam prestasi pertumbuhan dan kandungan klorofil apabila terdedah kepada keamatan cahaya yang rendah. Sebaliknya, hasil kecekapan fotokimia tidak banyak perbezaan antara bulan pengukuran. Nilai *Fv / Fm* yang direkod antara 0.79 hingga 0.84 menunjukkan bahawa semua daun spesies yang ditanam berada dalam tekanan.

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APPROVAL SHEET

I certify that this research project report entitled “Growth Performance and Photochemical Efficiency of *Magnolia Elegans* Planted In Restoration Area” by Muhammad Amirul Azimuallah Bin Azmin has been examined and approved as a partial fulfilment of the requirements for the Degree of Bachelor of Forestry Science in the Faculty of Forestry, Universiti Putra Malaysia.

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LIST OF ABBREVIATIONS

AGR_H	Absolute Growth Rate of Height
AGR_D	Absolute Growth Rate of Diameter
RGR_H	Relative Growth Rate of Height
RGR_D	Relative Growth Rate of Diameter
ΔH	Changes in height growth rate
ΔD	Changes in diameter growth rate
ΔT	Changes in time of experiment
ANOVA	Analysis of Variance
Chl	Chlorophyll
cm	Centimetre
CO_2	Carbon dioxide
Fo	Initial Fluorescence
Fm	Maximum Fluorescence
Fv	Variable Fluorescence
Fv/Fm	Photochemical Efficiency
MPIC	Ministry of Plantation Industries and Commodities
mm	Milimetre
PEA	Plant Efficiency Analyzer
PS ll	Photosystem ll
R & D	Research & Development
UPM	Universiti Putra Malaysia

CHAPTER 1

INTRODUCTION

1.1 General Background

Global warming is not a new issue in the world. The main reason of this changes was human activity. In its Fifth Assessment Report, the Intergovernmental Panel on Climate Change, a group 0f 1300 independent scientific experts from countries all over the world under the auspices of United Nations, concluded there's a more than 95% probability that human activities over the past 50 years have warmed our planet. Human activity is releasing vast amount of carbon dioxide (CO_2). Land-use changes such as destruction of tropical forest and the unsustainable exploitation are also giving an impact.

As the human population increases, the deforestation rates and the emissions of carbon dioxide into the atmosphere also increases so that it can cause the global warming. In order to cease any more increase of CO_2 in the atmosphere by means of additional plantation areas could be an important means. The global concern in ameliorating global warming and climate change so that they fulfilled their responsibility by expand the forest plantation in Malaysia.

The tropical forests make up 80% of the total world forests and are recognised as having the greatest long term potential to sequester atmospheric carbon (Nadagoudar, 2012). The reduction of natural forests, which are the main source of these resources, and the growing pressure for the conservation of these ecosystems underscore the importance of planted forests, which could supply up to 50% of the global demand for wood by 2050 (WWF 2012).

Compared to natural forests, forest plantation can produce far greater quantity of wood and non-wood produces within a relatively shorter period of time, from 3 to 30 years (Hashim *et al*, 2011). Furthermore, it also can act as store (sequester) the emissions greenhouse gas in the growth development process which in turn contributes to the global environment.

The establishment of forest plantation can deficit the problems of timber shortage and high pressure on natural forests caused by deforestation, where more information on selection of species and performance required in developing the successful plantation. Besides that, forest plantation also can help in depletion of carbon dioxide and act as a carbon sink through biochemical process photosynthesis. Forest, which are the main component of so-called 'land sinks', play a vital role in the global carbon cycle through the absorption of 2.9 6 0.8 Pg of carbon (C) per year (in the period of 2004 until 2013), thus mitigating climate change related to the increase of anthropogenic carbon dioxide (CO_2) in the atmosphere (Le Que're' et al. 2009).

Recently, *Magnolia elegans* species, a newly introduced forest plantation species has a great concern due to its characteristics such as this species can grow up to 53 metres and 115 centimetres in diameter. Other than that, its timber can be used in woodworking. This species was introduced to Malaysia based on the successful history of plantations in India and Southeast Asia especially on timber production and seemed to be able to meet the demand for sustainable wood production in the future.

1.2 Problem Statement

The information about the carbon sequestration's function of forests was a great concern not only for production but also to assess the possible effects on the global warming phenomenon. The forest plantation would play a leading role in the future. Nevertheless, fundamental information on the potential of planted ornamental species to the site quality and variation is scarce especially in Malaysia.

Most study of the forest plantation species was focused on species composition and growth. However, in term to grow trees efficiently, foresters must understand how trees grow and this requires some understanding of tree physiology (Kramer. P. J, 1986). Therefore, intensive research needs to be done to clarify the role of ornamental species in forest plantation.

In Malaysia, there are many microclimates such as temperature and rainfall that can be affecting performance of plants or trees even human activities. The climate of Malaysia are uniform temperature, high humidity and copious rainfall. Then, wind were generally light and variable. The seasonal wind flow patterns coupled with the local topographic features determine the rainfall patterns over the country. It is best to describe the rainfall distribution of the country according to seasons.

Therefore, the area of study still in restoration process which is that area is previously affected by extremely land clearing for agriculture. Pahang is the states in Malaysia that still have an expansive range of forest and they have a part of issues around unlawful logging. So, the government has acted based on this serious issue.

One easy way to combat deforestation at Cameron Highland is they should protect and conserve the area that become a favourite area of illegal logging. The agriculture and plantation location that had been forsake for a long-term have changed into an open area. The area that had been changed into an open area should be restored and conserved.

Magnolia elegans still a new species that had been introduced in Malaysia. The productivity and physiology data of *Magnolia elegans* are the important things in successful plantation. Therefore, the research on establishment and maintenance of *Magnolia elegans* are still in average and need more comprehensive research. Malaysia's climate and soil conditions are conducive for the growth of tree plantation like *Magnolia elegans*. So, this study is design to study the response of *Magnolia elegans* to our environment which is wet and dry season.

1.3 Objective

This study was conducted to determine the effect of environmental stress of *Magnolia elegans*. The specific objectives set to meet this study were:

1. To determine the effect of environmental stress on the photochemical efficiency of *Magnolia elegans* at the restoration area.
2. To study the effect of environmental stress on the growth performance of *Magnolia elegans* at the restoration area.

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