



**UNIVERSITI PUTRA MALAYSIA**

**RELIABILITY OF PCA LAI-2000 TO INDICATE FOLIAR NITROGEN  
CONTENT IN MATURE OIL PALM**

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**FP 2015 152**

RELIABILITY OF PCA LAI-2000 TO INDICATE FOLIAR NITROGEN CONTENT IN  
MATURE OIL PALM

BY

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A project report submitted to Faculty of Agriculture, University Putra Malaysia

In fulfilment of the requirement of PRT 4999 (Final Year Project)

For the award of the degree in Bachelor of Agricultural Science

Faculty of Agriculture

University Putra Malaysia

2014/2015

## CERTIFICATION

This research report entitled “Reliability of PCA LAI-2000 to Indicate Foliar Nitrogen Content in Mature Oil Palm” is prepared by Amiruddin Johari and submitted to the faculty of Agriculture in fulfilment of the requirement of PRT 4999 (Final Year Project) for the award of the degree of Bachelor of Agricultural Science.

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## ACKNOWLEDGMENT

In the name of Allah, the Most Gracious and the Most Merciful

Alhamdulillah, all praises to Allah for the strengths, courage, motivation and His blessing in completing this final year project research paper.

I am sincerely grateful to my supervisor Dr. Farrah Melissa Muharam for her guidance, continuous encouragement and constant support in making this project possible. I really appreciate her guidance from the beginning to the final level that enabled me to develop an understanding of this research thoroughly. I also thank her for the time spent reading and correcting my mistakes. Without her guidance and assistance, it would be impossible to complete this project.

I am greatly indebted to Mrs. Amiratul Diyana Amiruddin for her cooperation and guidance in completing this project. Many thanks to my colleagues who helped me in many ways to complete this project together.

Sincere thanks to all my friends especially Adzim, Zafrullah, Ain, Fikri, Wafi, Huzaifah, Hadi, Fakhrul, Deen and others for their kindness and moral support during my study. Thanks for the friendship and memories.

Last but not least, my deepest gratitude goes to my beloved parents; Mr. Johari B. Sulaiman and late Mrs. Rohayah Bt. Che Ani and also to my brothers, Amirul and Aiman, for their endless love, prayers and encouragement.

## TABLE OF CONTENT

|                                    | <b>PAGE</b> |
|------------------------------------|-------------|
| <b>CERTIFICATION</b>               | i           |
| <b>ACKNOWLEDGEMENT</b>             | ii          |
| <b>TABLE OF CONTENT</b>            | iii         |
| <b>LIST OF FIGURES</b>             | v           |
| <b>LIST OF TABLES</b>              | vii         |
| <b>ABSTRACT</b>                    | viii        |
| <b>ABSTRAK</b>                     | ix          |
| <b>CHAPTER 1 INTRODUCTION</b>      |             |
| 1.1 Introduction                   | 1           |
| 1.2 Objective                      | 4           |
| <b>CHAPTER 2 LITERATURE REVIEW</b> |             |
| 2.1 Leaf Area index (LAI)          | 5           |
| 2.2 Importance of LAI              | 5           |
| 2.3 Importance of N in oil palm    | 6           |
| <b>CHAPTER 3 METHODOLOGY</b>       |             |
| 3.1 Site description               | 12          |

|                  |   |    |
|------------------|---|----|
| 3.2              | Treatment   | 14 |
| 3.3              | Data Collection                                     | 14 |
|                  | 3.3.1 LAI measurement                               | 14 |
|                  | 3.4.2 Nitrogen content                              | 15 |
| 3.4              | Data analysis                                       | 16 |
| <b>CHAPTER 4</b> | <b>RESULT AND DISCUSSION</b>                        |    |
| 4.1              | Average LAI and Foliar Content Among Replications   | 17 |
| 4.2              | Average LAI and N Foliar Content Among Treatments   | 23 |
| 4.3              | Comparison of Data Between LAI and Weather Forecast | 30 |
| 4.4              | Relationship between leaf N content and SPAD value  | 31 |
| <b>CHAPTER 5</b> | <b>CONCLUSION</b>                                   | 35 |
| <b>REFERENCE</b> |   | 36 |
| <b>APPENDIX</b>  |   | 41 |

| <b>List of Figures</b>   | <b>Page</b> |
|--|-------------|
| Fig.2.1 LAI Estimation for Vegetables (Lucerne, Sunflower, Conola, Wheat, Rice, Maize and Sorghum) Crop                        | 8           |
| Fig. 2.2 Relationship between canopy height and LAI measured with direct harvest   | 10          |
| Fig.2.3 The standard 5R outputs and the reprocessed 4R ones are compared to direct measurement                                 | 11          |
| Fig. 2.4 Comparison for five forest types of effective LAI and 'true' LAI  | 11          |
| Fig. 2.5 Relationship between the SPAD reading and the total N content in leaf collected in grapevines (Brunetto et al., 2002) | 11          |
| Fig. 3.1 Map of Melaka Pinda 2002  | 13          |
| Fig. 3.2 Map of Melaka Pinda 2005  | 13          |
| Fig. 4.1 Average LAI of MP02 (February)  | 17          |
| Fig.4.2 Average LAI of MP02 (October)  | 18          |
| Fig. 4.3 Average LAI of MP05 (February)  | 19          |
| Fig.4.4 Average LAI of MP05 (October)  | 19          |
| Fig.4.5 Average Nitrogen Content MP02 (February)   | 20          |
| Fig. 4.6 Average Nitrogen Content MP02 (October)   | 21          |
| Fig. 4.7 Average Nitrogen Content MP05 (February)  | 22          |
| Fig. 4.8 Average Nitrogen Content MP05 (October)   | 22          |
| Fig. 4.9 Average LAI measurement Between MP05 and MP02   | 23          |

|           |  |    |
|-----------|--|----|
|           | (February)   |    |
| Fig. 4.10 | Average LAI measurement between MP05 and MP02          | 24 |
|           | (October)  |    |
| Fig. 4.11 | Average Nitrogen Content for MP05 and MP02             | 25 |
|           | (February)   |    |
| Fig. 4.12 | Average Nitrogen Content MP05 and MP02 (October)       | 25 |
| Fig. 4.13 | Average LAI for MP02 on February and October           | 26 |
| Fig.4.14  | Average LAI for MP05 February and October              | 27 |
| Fig.4.15  | Average Nitrogen Content on February and October       | 28 |
|           | (MP02)   |    |
| Fig.4.16  | Average Nitrogen Content on February and October       | 28 |
|           | (MP05)   |    |
| Fig.4.17  | Temperature, Relative Humidity (%) and Rainfall        | 30 |
| Fig.4.18  | Relationship Between Leaf N content and LAI value in   | 31 |
|           | February for Both Fields                               |    |
| Fig.4.19  | Relationship between leaf N content and LAI in October | 32 |
|           | for both fields  |    |



## Abstract

Oil palm is the golden crop of Malaysia, the vast production of palm oil have made Malaysia the second largest producer after Indonesia. Nitrogen (N) as the basic macronutrient serve as one of major fertilizers contributes to vegetative growth given appropriate manuring and fertilizing. Fronds growth of oil palm create canopy as the oil palm matured and canopy measurement can indicate vegetation growth. As N is responsible for vegetation growth, plant canopy in term of Leaf Area Index (LAI) that quantifies the amount of foliage area per unit ground surface area can be used as indirect method to asses foliar nitrogen. LAI, is therefore an important parameter controlling many biological and physical processes associated with vegetation on the Earth's surface, such as photosynthesis, respiration, transpiration, carbon and nutrient cycle, and rainfall interception. LAI is a required input to many climate and ecological models. This study conducted in United Malacca Berhad (UMB) plantation, the main objective of the study is to significantly identify the relationship of plant canopy (LAI) to foliar nitrogen content. Different N rates of 0, 1 and 2 kg/palm were applied on oil palm fields planted in 2002 and 2005. The parameters recorded were the LAI readings and foliar N content of the palm. For LAI measurement, PCA LAI-2000 was used to estimate LAI of oil palm. The relationship between foliar N content and LAI value of oil palm leaves were analyzed and the results showed weak relationship explaining these two parameters, where the linear regression illustrated the highest  $R^2$  value of 0.253. It is concluded that PCA LAI-2000 is not a reliable tool to estimate foliar N content via LAI or canopy cover consisted in mature oil palms in fields.

## Abstrak

Kelapa sawit adalah tanaman yang dikenali sebagai tanaman emas dan Malaysia menjadi negara pengeluar kedua minyak sawit selepas Indonesia. Nitrogen pula adalah asas keperluan dalam pembajaan dan menyumbang kepada pertumbuhan hijauan. Manakala indeks keluasan daun (LAI) adalah bersamaan dengan pertumbuhan hijauan per keluasan tanah. LAI dengan ini boleh menjadi ukuran yang penting dalam proses biologikal dan fizikal dalam pertumbuhan hijauan bagi pokok, seperti fotosintesis, respirasi, transpirasi, karbon dan kitaran nutrien, serta penurunan hujan. LAI juga adalah input dalam keadaan cuaca berbagai pembinaan model ekologi. Dalam penyelidikan ini, objektif utama adalah untuk mengenalpasti hubungan antara kanopi tumbuhan dan kandungan nitrogen dalam daun. Penyelidikan ini dijalankan di United Malacca Berhad, kadar nitrogen (0,1,dan 2 kilogram nitrogen) digunakan dalam lapangan 2002 dan 2005 untuk melihat hubungkait antara LAI dan kandungan nitrogen dalam daun. Ukuran yang digunakan adalah bacaan LAI dan kandungan nitrogen dalam daun. Bagi bacaan LAI, PCA LAI-2000 digunakan untuk menganggar bacaan LAI. Seterusnya bacaan LAI dan kandungan nitrogen dianalisa dan didapati tiada signifikansi antara kedua-dua LAI dan nitrogen dalam daun. Bagi regresi linear, hubungan antara LAI dan nitrogen adalah lemah dengan bacaan  $R^2$  tertinggi pada 0.253. Projek ini mendapati bahawa PCA LAI-2000 adalah peralatan yang tidak boleh digunakan dalam menganggar nitrogen dalam daun melalui kadar keluasan daun dalam pokok kelapa sawit matang.

## CHAPTER 1

### INTRODUCTION

#### 1.1 Introduction

Malaysia is second largest producer of oil palm after Indonesia, the needs and necessities of crude palm oil is essential in the world nowadays. Demand for food increased as world population keep increasing in numbers, these lead to bigger problem of food scarcity and food availability. Vegetable oil produce by oil palm is more effective and economically consistent in term of productivity per acreage.

Malaysia currently accounts for 39 % of world palm oil production and 44% of world exports. If taken into account of other oils & fats produced in the country, Malaysia accounts for 12% and 27% of the world's total production and exports of oils and fats. Being one of the biggest producers and exporters of palm oil and palm oil products, Malaysia has an important role to play in fulfilling the growing global need for oils and fats sustainably (MPOC, 2006).

Being among world largest producer and advance technical technology in oil palm industry, the future ahead does't secure consistent productivity if there is no solution in advancing in research and development of oil palm industry. Disease, global forecast and global warming play vital role in producing varied outcome from the oil palm industry. Future production depends on how to manage the variability and securing oil palm industry from falling in economic failure.

One of important variability is soil nutrients and contents. Enriching soil with different type and amount of fertilizer gives different growth pattern of oil palm. Thus, fertilizing is one important criteria in oil palm management. Nitrogen is basic requirement for vegetative growth of oil palm, these include canopy formation, lengthening stem and fronds. Nitrogen (N) is the most important limiting factor for crop productivity after water. Despite being a dominant factor in oil palm production and quality improvement, the excessive use of N fertilizer has reduced N use efficiency and caused severe environmental threats (Jeuffroy et al., 2002). Problem arised if fertiliser given not absorbed efficiently by the crop, leading to destruction and deteriorating environment and ecology of living things. Therefore, the fertilizer recommendations seen on the estates, which often appear to be taken for granted, require a good understanding of the general principles governing the mineral nutrition of oil palm (Corley and Tinker, 2003; Goh and Hardter, 2003a) and methods to maximize fertilizer use efficiency (Goh et al., 1999a; Goh et al., 2003). Over-used of fertiliser leads to leaching, soil erosion and adversely an impact to environmental health. Research has been made in discovering an optimum application of fertiliser especially nitrogen as one of the major

and main fertilising component. Urea and ammonia chloride widely used as source of nitrogen in big plantation company.

Foliar sampling is one method of detecting nitrogen in leaf as one of satisfactory method for determining the means of correcting deficiency symptoms and for increasing the overall production of existing oil palm plantations. This method defined as the interpretation of the changes in the chemical composition of leaves is based on the conception that growth and production are directly related to the concentration of nutrients in the leaf tissue, irrespective of the character of the nutrient medium. It is directly determined nutrient status of the palm. This method often relate to laborious work and expensive method in directly determine foliar nutrient analysis.

Since N concentration is found to influence Leaf Area Index (LAI) reading (Pierce et al., 1994), LAI could be utilized as an indirect method to determine nitrogen content as LAI can be defined as the assimilative leaf area relative to the projected ground area for a plant community (one-side area for broad-leaved trees) (Lang et al, 1991). It is fast, accurate and non destructive measurement of leaf area index of plant canopies

## 1.2 Objective

The present study is intended to evaluate if an indirect method of LAI would allow a better diagnosis of mature oil palm N nutrition status. The projected results would provide a new methodology for indirect estimation of crop N status and can be used for guiding precision N management during the growth period of oil palm.



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