

# INTERNATIONAL CONFERENCE ON

# BALANCED NUTRIENT MANAGEMENT FOR TROPICAL AGRICULTURE

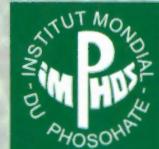
- ↗ 12-16th APRIL 2010
- ↗ SWISS GARDEN RESORT & SPA,  
KUANTAN, PAHANG, MALAYSIA

## ABSTRACT

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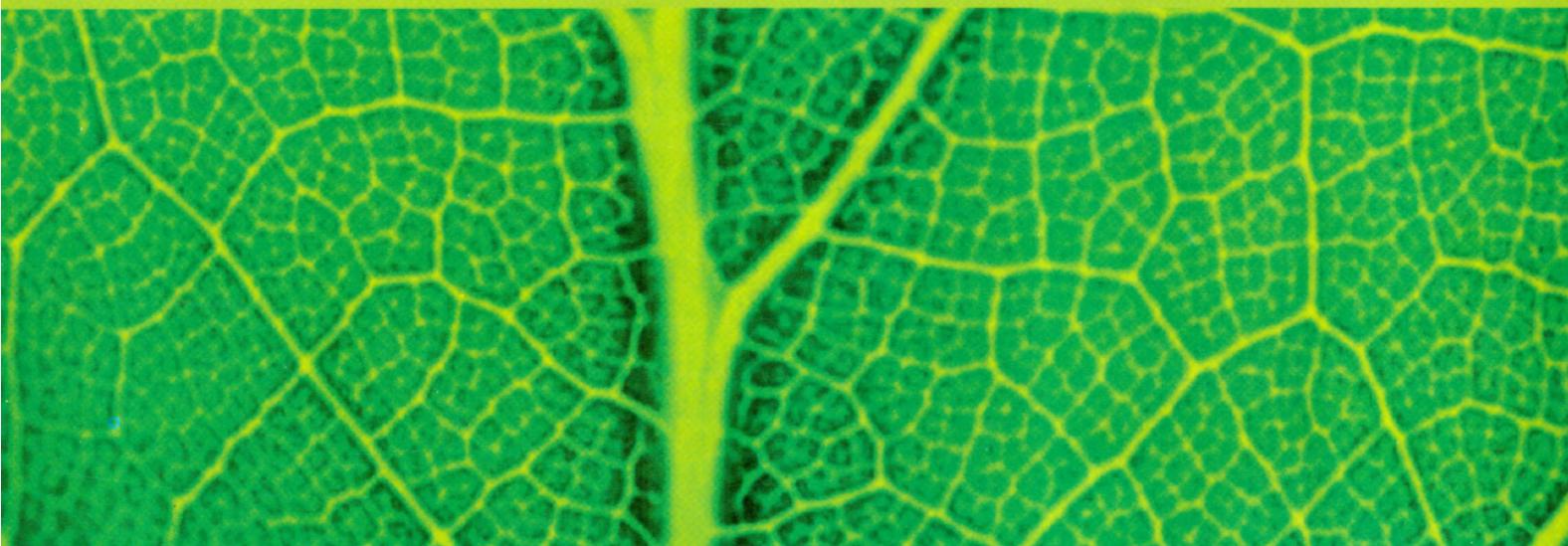
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**The Secretariat**  
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## DEVELOPMENT OF AN IMPROVED OIL PALM GROWTH AND YIELD MODEL:PRELIMININARY REPORT

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### INTRODUCTION

Development of improved oil palm growth and yield model is important since oil palm is the major crop in Malaysia. Field experiments are prohibitive mainly due to the high cost to setup a large and long term field experiments required to study the effects of climate change on the growth and yield of the oil palm. Therefore, simulation studies are essential alternative.

### MATERIALS AND METHODS

The oil palm model has seven core components. The first component is the simulation of hourly weather properties based on daily weather data. The second component is the interception of solar radiation that is based on modified form of Beer's Law to account for discontinuous canopies. The third component is the mechanistic photosynthesis model by Collatz et. al. (1991) which describes that photosynthesis is either limited to Rubisco, light or sink. The fourth component is estimating the effects of ground level ozone on oil palm photosynthesis. The method by van Oijen et al. (2004) was adapted. The fifth component is the partitioning of the assimilates from photosynthesis for maintenance and growth respiration. The method by van Kraalingen et al. (1989) was adapted. The sixth core component is the modelling the water balance in the oil palm environment based on the Shuttleworth-Wallace (Shuttleworth and Wallace, 1985) equation and the modelling of soil water content in the soil. The soil was divided into six layers. Water flow was based on Darcy's law. The soil water property was generated using method by Saxton et al. (2006). The seventh component is the generative organ growth using boxcar train technique and the incremented of the organ weight and yield.

### RESULTS AND DISCUSSIONS

The preliminary report of oil palm yield model consists of effects on different planting densities and the ground level ozone. The graph on Figure 1 shows the simulated oil palm yield in tonnes per hectares for four different planting densities which is 56, 110, 148 and 186 palms/hectares respectively. The oil palm yield for four different planting densities has all observed peak on the fifth year of planting. Lower planting densities indicated the higher yield.

Effects on five different ground level ozone concentrations which is 0, 15, 20, 60 and 100 nmol mol<sup>-1</sup> on oil palm yield is shown in Figure 2. Planting density is taken as 148 palms/hectares and leaf area index is taken as 5. The observed peak is on the sixth year of planting. Higher ground level ozone concentrations reduced the yield about 59.2%. Figure 4 shows the validation ground level ozone concentration on 148 palms/ha with LAI taken as 5. The two estimate trends are for 0 and 5 ppbv background ozone concentration. Estimations included ozone formed from isoprene emission by oil palm.

The measured values over several days varied between  $0.36$  to  $9.45 \text{ nmol mol}^{-1}$  with a mean of  $2.9 \text{ nmol mol}^{-1}$ .

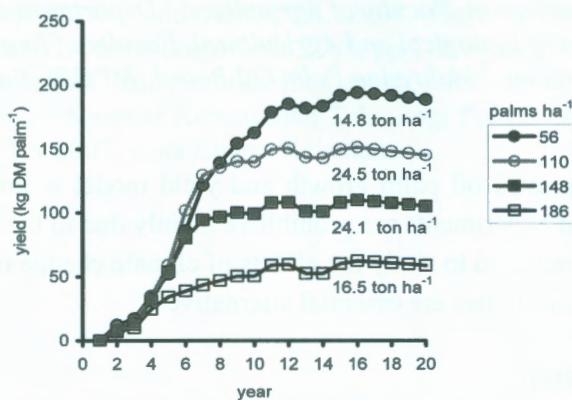


Figure 1: Oil palm yield for different planting densities (mean yield expressed as tonnes per hectare)

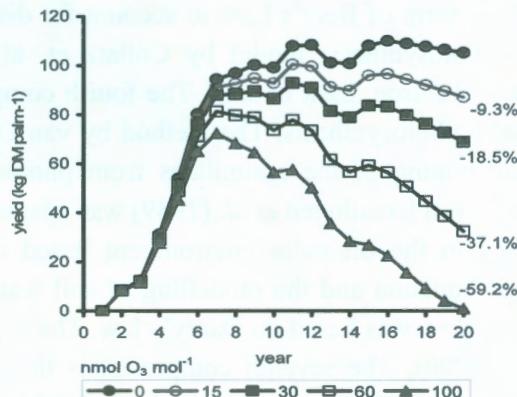


Figure 2: Effect of various concentration levels of ground level ozone ( $\text{nmol mol}^{-1}$ ) on oil palm yield (LAI 5 and 148 palms  $\text{ha}^{-1}$ )

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