Plantation Intelligence®
Analysis of Commercial Data for Yield and Fertilizer Management in Oil Palm

Oberthür, Chua, Cook, Donough, Cock, Lim, Mohanaraj, Rachel & Kam

XVIII Conferencia Internacional Sobre Palma de Aceite
18th International Oil Palm Conference

22 al 25 de Septiembre de 2015
Cartagena de Indias, Colombia
1 Conceptual Background
IPNI 4R Nutrient Stewardship

Source, Rate, Time, Place

Oberthür et al.
18th International Oil Palm Conference. Cartagena de las Indias
Cartagena de las Indias

Complex interactions in an agronomic system render outcomes of any management decision uncertain.
Decision Making Uncertainty

**METRIC**
Uncertainty about rate & placement of fertilizer to support a yield target

**TEMPORAL**
Uncertainty about timing of fertilizer applications, e.g. drought interference

**TRANSLATIONAL**
Uncertainty from external factors that reduce fertilizer performance, e.g. harvest, mill and transport efficiency

**STRUCTURAL**
Uncertainty from internal factors that influence fertilizer efficiency, e.g. EFB applications

Example: **ROI in Fertilizer**

Fruit is grown but not harvested

Only with enough labor, all fruit is harvested

Fresh Fruit Bunch Yield in t per ha

Expected yield level

Harvest Man days
Decision Making Uncertainty

**EXPECTATION**

Yield Made

**VS.**

Yield Taken

**REALITY**
(business) intelligence is “the ability to apprehend the interrelationships of presented facts in such a way as to guide action towards a desired goal.”
System is Monitored in Extraordinary Detail
Devise specific performance intervention options (EVALUATE)

Organize existing performance data (VISUALIZE)

Generate performance indicators and metrics (ANALYSE)

Quantify performance change for management (DECIDE)

Exogenous
An adaptive learning process based on the analysis of plantation data
2 Application Examples
Current Protocols

Yield Age Profiling

Yield Soil Interactions

Yield Trends

Yield Soil Climate Interactions

Naïve Gross Margins

Yield Labor Interactions

Fertilizer Response Analyses
Yield Age Profiling

![Graph showing FFB (t/ha) against Tree Age (TREAGE) with data points and box plots for different age ranges.](image-url)
Yield Age Profiling

FFB (t/ha)

TREEAGE
Yield Benchmarking

1. Average yield profile mirrors that of potential

2. Yield gap between average and potential

3. Blocks approach yield potential

4. Blocks above potential require further assessment

PALMSIM Model
Agricultural Systems, 131:1-10 (2014)
Naïve Gross Margins

Cost = 500 $US per ha per year  
“i.e. a favorable benchmark”
Naïve Gross Margins
Naïve Gross Margins

Average naïve gross margin in USD per hectare

Individual Block

[Graph showing data distribution]
3 Response to Fertilizer
NPKMg

BREAK-EVEN point

8–10 kg fresh fruit bunches per kg nutrients
Sum of NPKMg

2.5 years to 0.5 year before harvest
Tree Age Effects

Steep Ascent: Palm age from 3-5

\[ y = 12.908 + (0.011 \times x) \]

Plateau: Palm age from 6-13

\[ y = 22.233 + (0.005 \times x) \]
Annual Response 2012

Fresh fruit bunches in tons per hectare

NPKMg3yW_IN
Fresh fruit bunches in tons per hectare

- **SMG A**
  \[ y = 14.481 + (0.024 \times x) \]

- **SMG B**
  \[ y = 32.489 + (-0.015 \times x) \]

- **SMG C**
  \[ y = 36.217 + (-0.022 \times x) \]

- **SMG D**
  \[ y = 21.142 + (-0.003 \times x) \]
Annual Response 2014

Fresh fruit bunches in tons per hectare

y = 50.634 + \(-0.054\)x

y = 13.470 + \(0.025\)x

y = 13.972 + \(0.025\)x

y = 3.256 + \(0.036\)x

SMG A

SMG B

SMG C

SMG D
‘Contrast Method’

Yield Response \( (t \text{ FFB ha y}) \)  
\[ = F_1 (PV_1, PV_2, \ldots PV_N, PV_{NPKMg}) \]

Yield Response \( (t \text{ FFB ha y}) \)  
\[ = F_2 (PV_1, PV_2, \ldots PV_N) \]

Response Contrast \( (t \text{ FFB ha y}) \)  
\[ = F_2 - F_1 \]
Visualizing Local Response

Contrast in t FFB per ha per year relative to yield without fertilizer:
- 1.40
- 0.00
- -0.75
Visualizing Local Response

Contrast in t FFB per ha per year relative to yield without fertilizer

- 1.40
- 0.00
- -0.75
Systems Solutions

Business Opportunity
PALMSIM Model

Measure Performance
Plantation Intelligence®

Estate Networking
The Benchmark Club

Continuous Improvement
Best Management Practices
IPNI Southeast Asia Program

XVIII Conferencia Internacional Sobre
PALMA DE ACEITE
18th International Oil Palm Conference

22 al 25 de Septiembre de 2015
Cartagena de las Indias, Colombia