Are we ‘fiddling whilst Rome burns’?

Yield improvement – the keystone of sustainability?

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Major challenges to feed the world with sustainable palm oil

- A requirement for a further 12 million ha of oil palm by 2050 even if yields average 5.2 t/ha by 2050 and soyabean maintains its market share*.
- Limited availability of land in SE Asia but what about
  - Africa?
  - C and S America

*Corley, 2009
Strategies to increase crop production – relevance to oil palm

<table>
<thead>
<tr>
<th>#</th>
<th>Strategy</th>
<th>Comments</th>
<th>Scope for oil palm</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Area increase</td>
<td>Shortage of suitable land</td>
<td>Limited?</td>
</tr>
<tr>
<td>2</td>
<td>Yield increase</td>
<td>Huge scope for improvement</td>
<td>High</td>
</tr>
<tr>
<td>3</td>
<td>Number of crops per year</td>
<td>Not applicable</td>
<td>None</td>
</tr>
<tr>
<td>4</td>
<td>Displace lower yielding crops</td>
<td>Indirect effect</td>
<td>High</td>
</tr>
<tr>
<td>5</td>
<td>Reduce post harvest losses</td>
<td>Requirement to improve oil yield</td>
<td>High</td>
</tr>
<tr>
<td>6</td>
<td>Reduce use as feed for animals</td>
<td>Provides animal feeds as by-product</td>
<td>High</td>
</tr>
</tbody>
</table>

Evans, 1998

Yield and RSPO criteria

• Yield is mentioned once in the RSPO Principles and Criteria under Principle 4 (4.2 - Practices maintain soil fertility at, or where possible improve soil fertility to, a level that ensures optimal and sustained yield.
• Yield – should be a primary goal for sustainable palm oil production and RSPO certification?
• Palm oil yields in RSPO certified plantations in Indonesia and Malaysia are about 1 t ha\(^{-1}\) greater than national averages.
What is the attainable yield on suitable land?

- Corley 2006
- Best small estates
- BMP IPNI SEA
- SEA
- S America
- C America
- W Africa

Oil yield (t ha⁻¹)

Yield gap 1
Maximum economic yield
Yield potential of progeny for a given soil and climate

Yield gap 2
Yield reduced because of nutrient deficiencies

Yield gap 3
Yield reduced because of poor management

Y-a
Y-n
Y-mey
Y-max

% potential yield
Benefits of yield improvement

- Profitability increased!
- Land spared for wilderness or other crops when coupled with proper land use planning
- Reduced carbon payback time
- Increased yield of CH₄ for electricity co-generation

Sustainable use of fertilizers

- Increasing yields doesn’t necessarily require more fertilizer — emphasis should be on efficient fertilizer use!
- Emissions associated with increased fertilizer use on existing land smaller than emissions from clearing new land.
- Importance of measuring agronomic efficiency (i.e., how much extra oil per kg of additional fertilizer) — a possible criteria for RSPO?
Crop protection and use of agrochemicals

• Herbicides are essential for maintaining proper ground cover and achieving high yields
• Importance of measuring agrochemical use (kg active ingredient per kg oil produced).
• A possible criteria for RSPO?

The importance of record keeping

• Records of yield, leaf and soil analysis, fertilizer and agrochemical use should be compiled in a database
• An essential tool for site specific management.
• Provides the means to assess:
  – Site utilization efficiency
  – Input use efficiency
• Cargill uses a customized database programme to maintain records of all agronomic parameters
Analysis of yield trends over time

Analysis of yield gaps
Individual block records

Use of 'BMP blocks', where all manageable agronomic constraints are removed to provide a benchmark of attainable yield.

Estate yield assessment

In the financial year 2011-2012 Hindoli achieved 81% of site yield potential
Huge loss of revenue if some loose fruit are left in the field.

In a 10,000 ha estate, 4 uncollected loose fruit per palm per harvest means a loss of at least US$ 0.74 million!
Analysis of trends for soil erosion

An index for site utilization?

• A measure of site utilization: aggregated actual yield as a percentage of site attainable yield?
• A means to assess yield?
Problems with yield intensification

• Time lag between implementation of improved agronomic practices and their impact on yield
• Yield intensification needs long term commitment and patience from investors.
• Need for well trained and motivated staff at all levels to implement best agriculture practices

Reduced sex ratio
Stress feedback
Abortion
Inflorescence development

Inflorescence primordium visible
1st bract
Spikelet initiation
Spear leaf
Inflorescence abortion
Anthesis and pollination
Bunch development
Bunch harvest

Leaf axil number relative to unopened leaf

Timescale (years – assuming about 24 leaves per year)

Jones, 1997
Cargill invests in oil palm industry education in Indonesia

- Major initiative to support education of young plantation executives.
- Collaboration with Institut Pertanian Bogor.
- Practical ‘on–farm’ training.

Importance of good extension materials

- How to perform each task
- Health and safety precautions
- Environmental and sustainability issues
- Means to assess whether standards have been achieved in the field.
Conclusions

• More explicit recognition of yield as a primary driver of sustainable palm oil production required?

• Include an index for ‘Site Utilization Efficiency’ in the Principles and Criteria for RSPO certification?

• In line with continuous improvement (ISO 9000)

References


