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Note: this lecture is a summary of presentations made at the “Palm Oil: The Sustainable 21<sup>st</sup> Century Oil” conference organised by the Lipids Group of the SCI in March 2009. As such, the opinions expressed are not necessarily those of Unilever, but those of the presenters.





# Palm Oil – The Sustainable 21<sup>st</sup> Century Oil

Photo: MPOB

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# Palm Oil – The Sustainable 21<sup>st</sup> Century Oil

- **The Lipids Group of The Society of Chemical Industry**
- **Sponsors:**
  - Malaysian Palm Oil Board
  - Malaysian Palm Oil Council
- **Royal Society, London**
- **23<sup>rd</sup>-24<sup>th</sup> March 2009**



# Conference Programme



# Monday 23<sup>rd</sup> March

1. The challenges facing palm oil in the 21st century	James Fry	LMC International, UK
2. Sustainable Palm Oil developments in Malaysia	Mohd. Basri Wahid	MPOB, Malaysia
3. Sustainable Palm Oil developments in Indonesia	Rosediana Suharto	IPOB, Indonesia
4. Sustainability & New Britain Palm Oil	Andrew Worrall	New Britain Palm Oil, UK
5. Sustainable palm Oil Developments in Brazil	Marcel Brito	Grupo Agropalma, Brazil
6. Palm Oil prospects in the USA	Gerald McNeill	Loders Croklaan, USA
7. Recent Trends: Vegetable oils and Tanker Markets	Fred Doll	Doll Shipping Consultancy, UK
8. Future prospects for palm oil in the 21st century: Biological and related challenges	Denis Murphy	Univ. of Glamorgan, UK

# Tuesday 24<sup>th</sup> March

1. Nutritional Aspects of Palm Oil	Tom Sanders	Kings College London, UK
2. Minor components in palm oil and their health benefits	Kalanithi Nesaretnam	MPOB, Malaysia
3. Technological Advances in Food Formulation based on Palm Oil	Nor Aini Idris	MPOB, Indonesia
4. Future prospects for Palm Oil processing	Véronique Gibon	De Smet, Belgium
5. Biodiesel from palm oil in comparison with other renewable fuels	Wolfgang Rupilius	Germany
6. Palm Oil Methyl Esters: Sustainable and Environmentally Friendly Feedstocks for Oleochemical and Biodiesel Industries	Salmiah Ahmad	MPOB, Malaysia
7. Life Cycle Assessments of palm oil and other vegetable oils	Erich Dumelin	Switzerland
8a. Greenpeace's view of Palm Oil b. Response from MPOC c. Response from IPOA	Andy Tait Yusof Basiron Derom Bangun	Greenpeace, UK MPOC, Malaysia IPOA, Indonesia

# Topic Overview



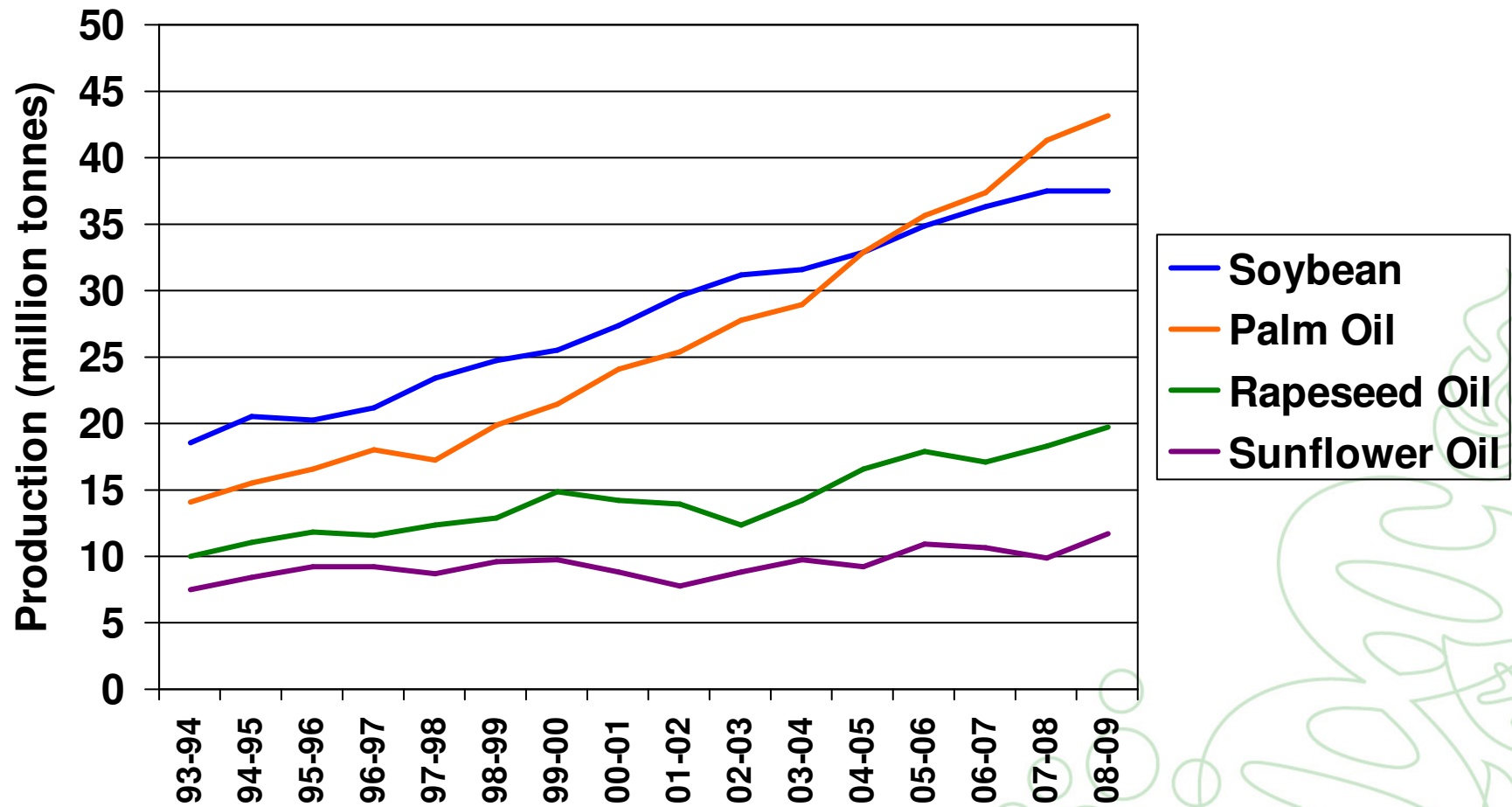
- 1. Palm Oil – The Past & The Future**
  - 2. Processing**
  - 3. Food Applications**
  - 4. Nutritional Properties**
  - 5. Biofuel**
  - 6. Sustainability**
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# Palm Oil – The Past & The Future

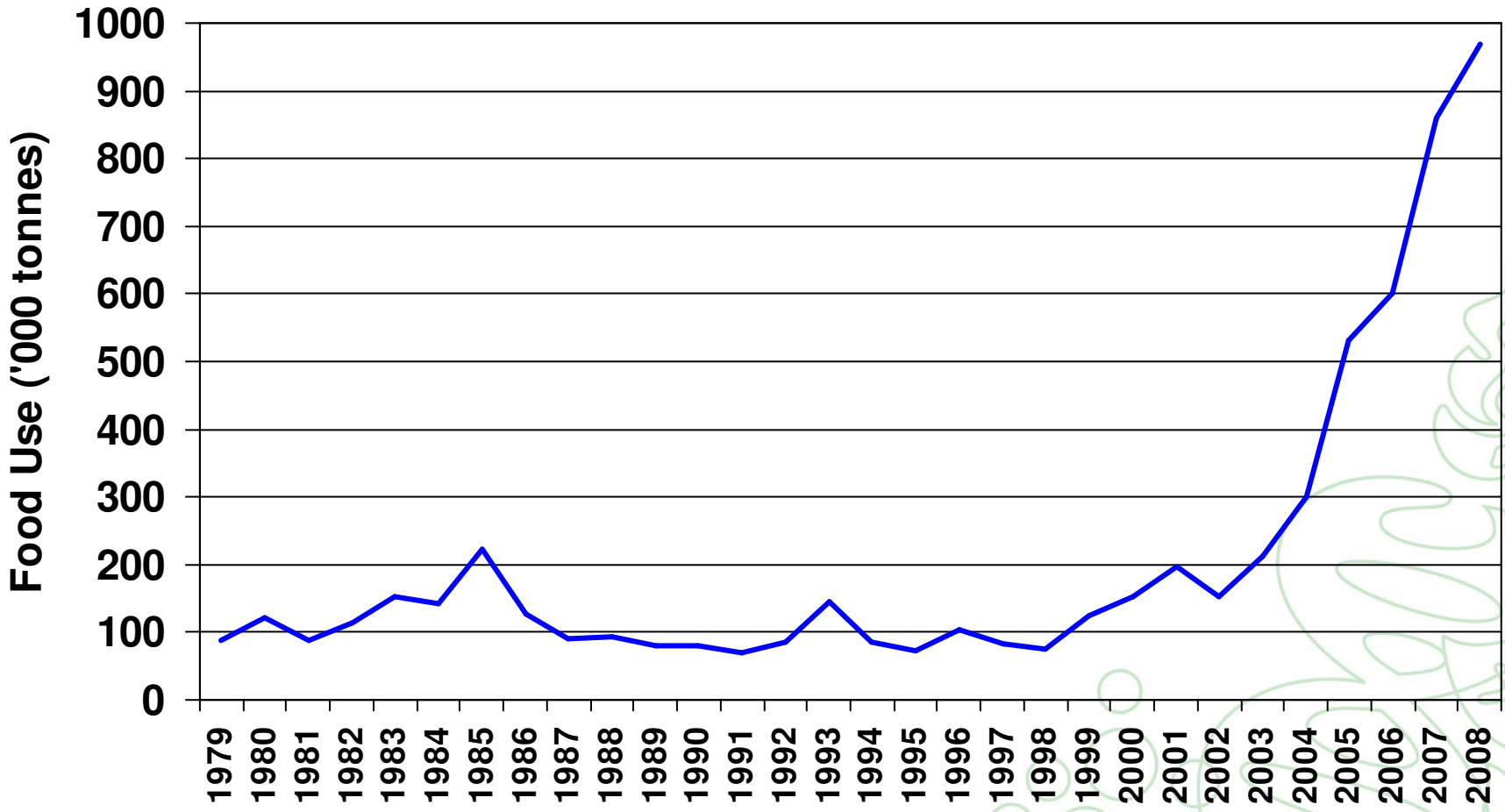




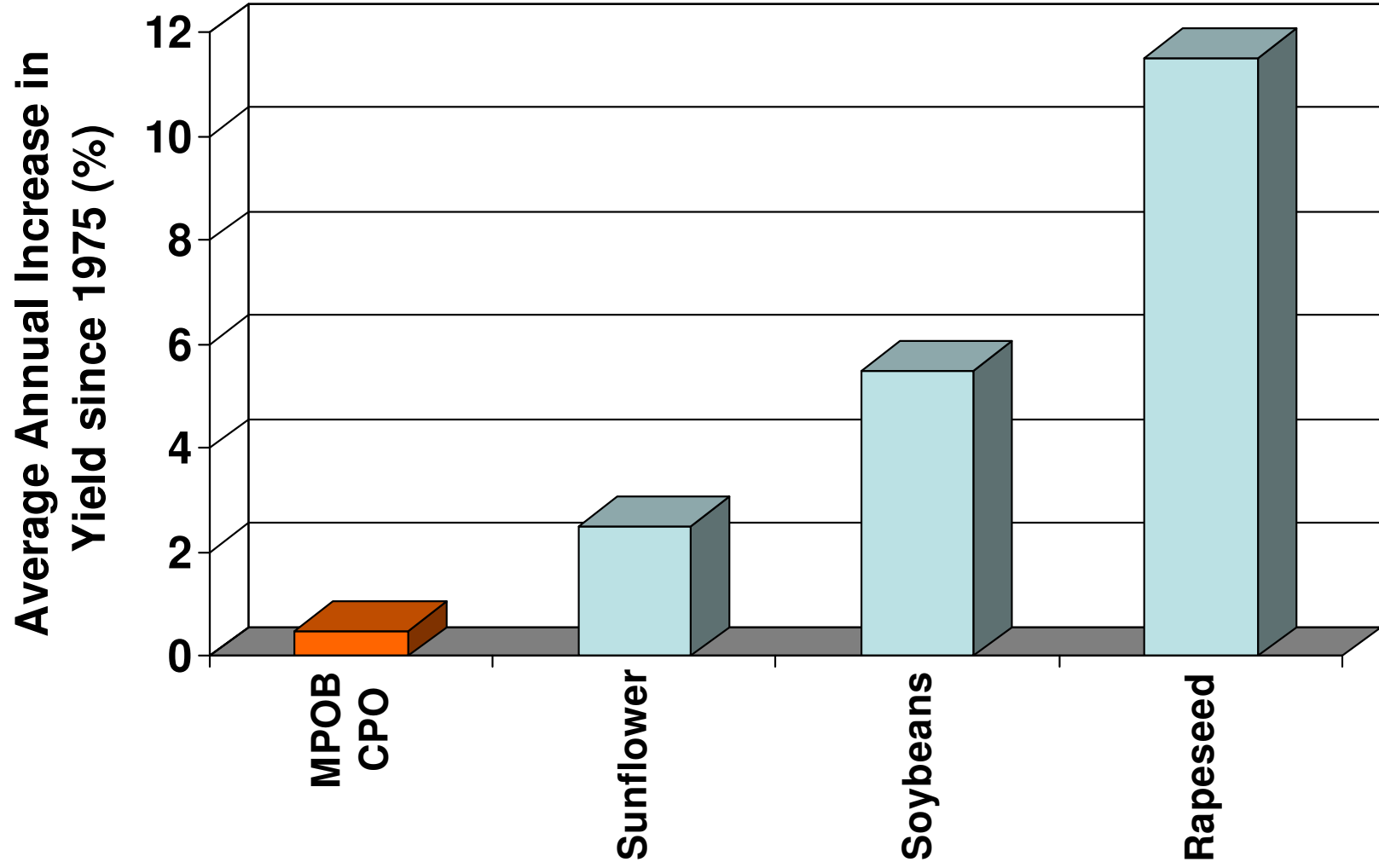
# Main Vegetable Oil



# Palm Oil in the USA



# Key Challenges



# Biotechnology



- **Increase yield**
  - **Tailor fatty acid composition**
    - Issues of IP
    - Fractionation better route
  - **Time to fruit means slow development**
  - **Biotech tools can speed it up**
    - Clonal propagation
    - Transgenics
    - DNA marker assisted selection
    - Genomics
- 

# Processing



# Palm Oil Processing



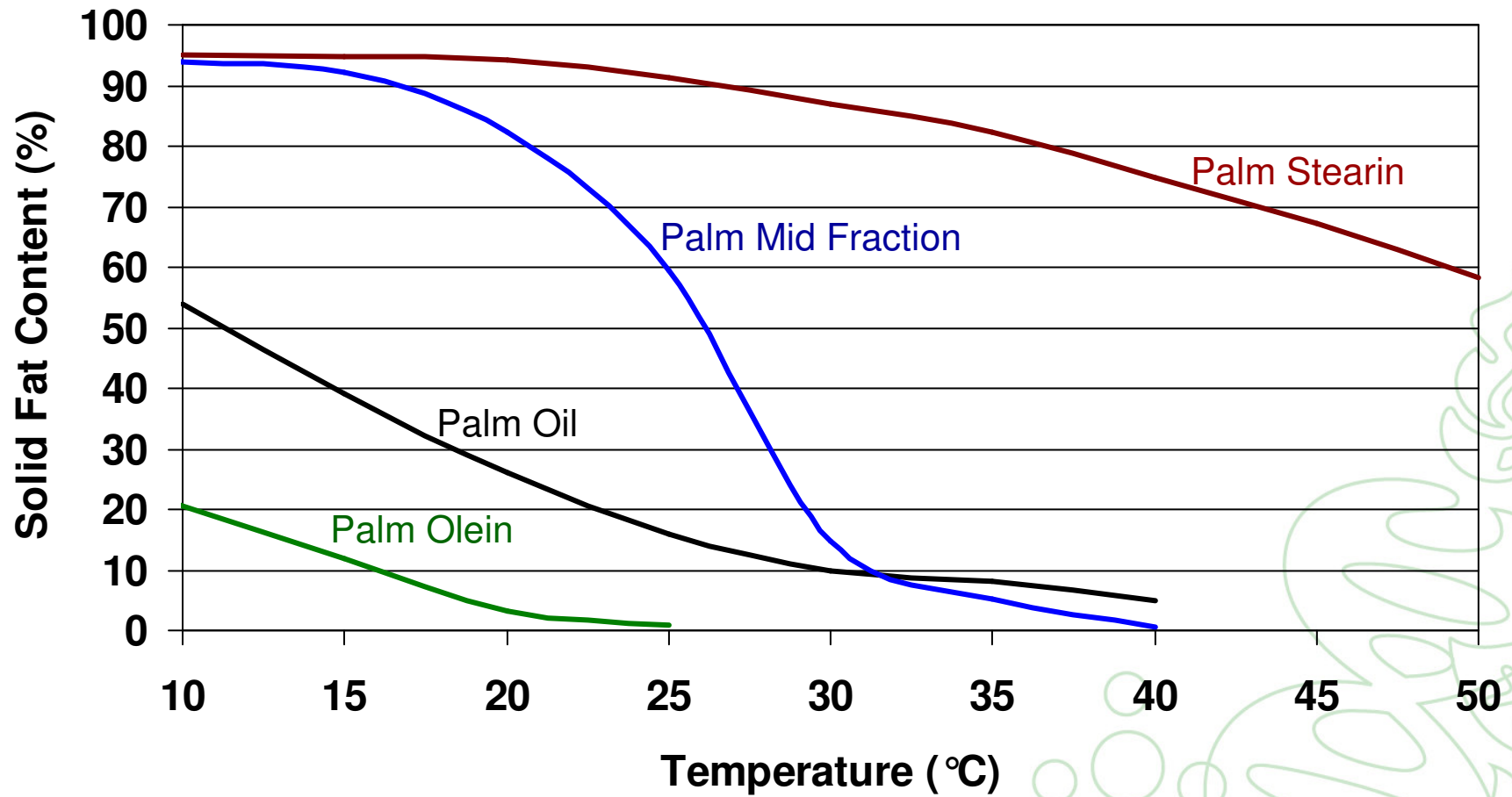
- **Quality of prime importance**
  - Fresh, unbruised fruit
  - Handled carefully
  - DOBI
- **Refining**
  - Mainly physical
  - Deodorisation critical
- **Fractionation**
  - Range of fractions available
  - Blends enable wide range of properties
- **Enzyme processing**
  - Cocoa butter equivalents



# Food Applications




# Palm Oil Flexibility





# Wide Range of Food Products



- **Hard / soft margarine**
  - **Ice cream**
  - **Bakery shortenings**
  - **Vegetable ghee**
  - **Non-dairy creams**
  - **Chocolate spread**
  - **Confectionery coating fats**
  - **Frying oil**
  - **Vegetable fat cheese**
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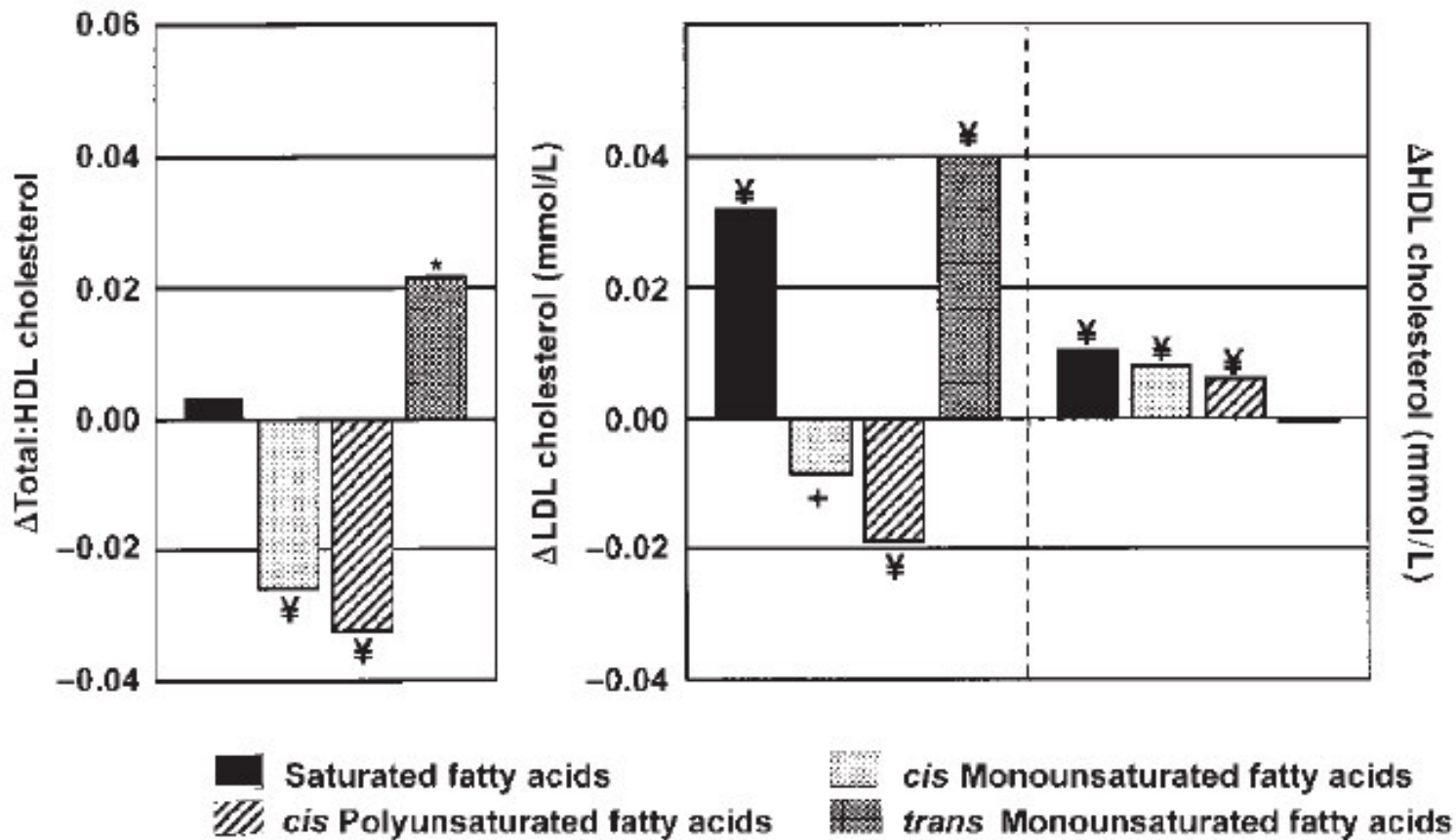
# Nutritional Properties



# Fatty Acids

## Replacing 1% carbohydrate isoenergetically

Mensink RP, et al., Am J Clin Nutr 2003;77 1146-1155

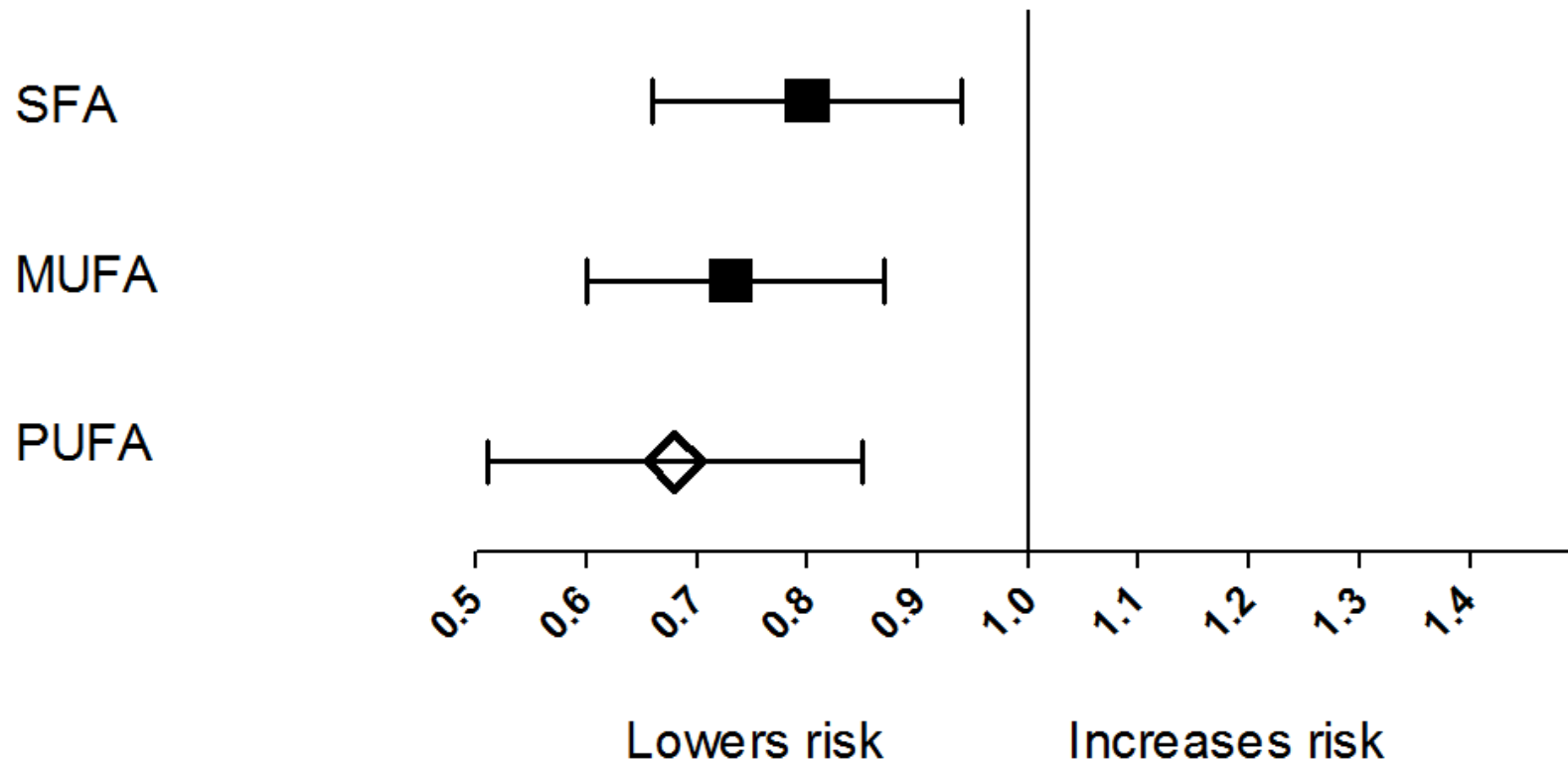


# Fatty Acids

## Replacing 5% carbohydrate isoenergetically

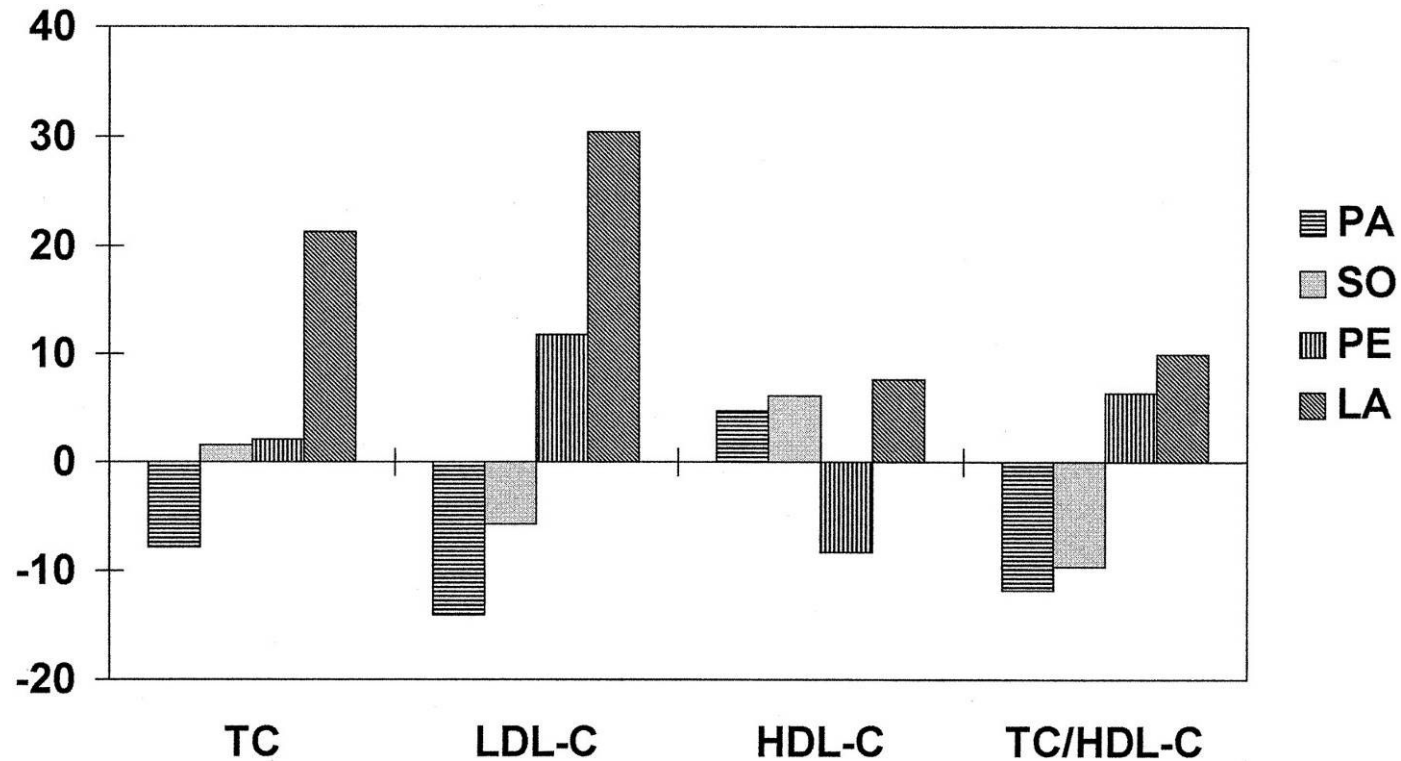
- Analysis of 11 cohort studies

Jakobsen M, et al., Am J Clin Nutr 2009;89 1-8



# Comparison with other fats

Zhang J, et al., J Nutr 1997:127 5098-



**Hypothesis: saturated in sn-2 position is bad!**

# Minor Components



- **Palm oil contains about 1% phytonutrients**

(Choo et al. 2008)

**Tocopherol, tocotrienol**      **600-1000 ppm**

**Carotenoids**      **500-1000 ppm**

**Phytosterols**      **300-620 ppm**

**Squalene**      **250-800 ppm**

**Phospholipids**      **20-100 ppm**

**Co-enzyme Q10**      **10-80 ppm**

**Polyphenols**      **40-70 ppm**



# Biofuel



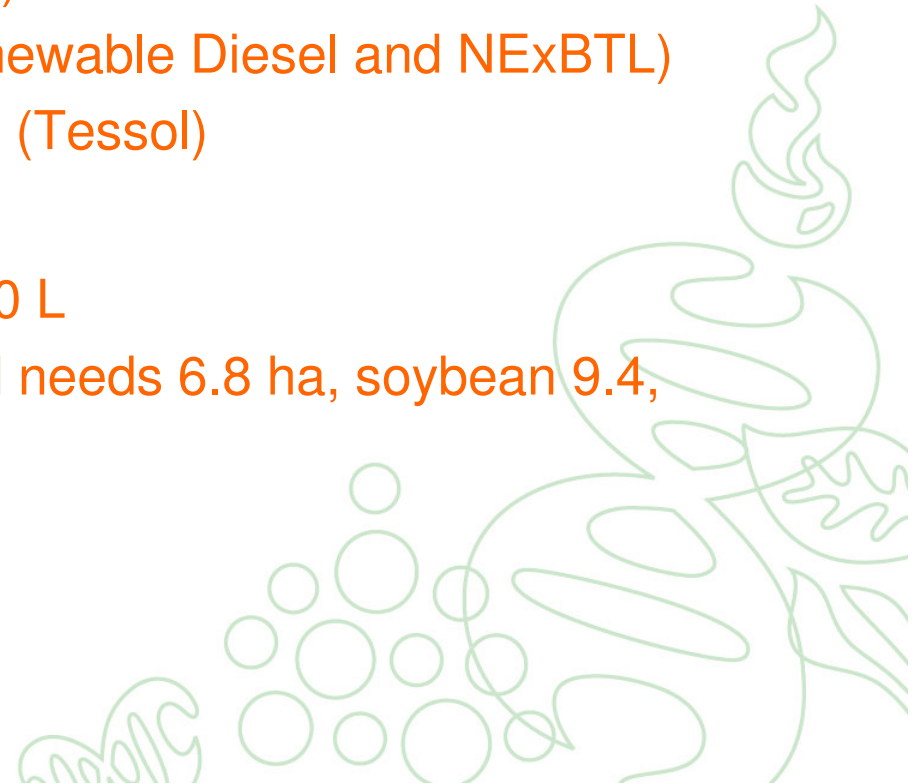
# Biodiesel

- **Various types**

- Fatty acid methyl ester (FAME)
- Vegetable oil methyl ester (VOME)
- Palm olein + mineral diesel (Envodiesel)
- Diesel from biomass (Sun Diesel)
- Hydrocarbons from oils/fats (Renewable Diesel and NExBTL)
- FAME, triglycerides & bioethanol (Tessol)

- **Biodiesel yield**

- 1 ha of palm oil yields about 3750 L
- For equivalent volume, rapeseed needs 6.8 ha, soybean 9.4, sunflower 7.5
- Annual car mileage / ha:
  - Soyabean 8,000 km
  - Jatropha 45,500 km
  - Palm 109,000 km





# Sustainability




# People – Planet - Profit



- **Roundtable on Sustainable Palm Oil (RSPO) established just over 5 years ago**
  - **Several plantations now certified as meeting Principles & Criteria of RSPO**
  - **First shipment of certified Sustainable Palm Oil arrived in Rotterdam in November 2008**
- 

# Greenpeace View

The top of the slide features a green banner with the text 'Greenpeace View' in white. To the right of the text, there are decorative elements including a stylized green leaf, a yellow recycling symbol, and a green circular pattern.

- **Priority to reduce GHG emissions**
    - Energy production
    - Transportation
    - Deforestation
  - **Targeted Indonesia as 3<sup>rd</sup> largest source of GHG**
    - Deforestation
    - Peatland exploitation
  - **Palm oil key driver for deforestation**
  - **Not against palm oil; want to work with companies to develop solutions**
  - **Want moratorium on further deforestation**
- 
- A faint, light green illustration in the bottom right corner shows a person holding a large plant, possibly a palm tree, with a flame above it, symbolizing environmental impact or climate change.

# Greenpeace View

*The best projections tell us that we have less than 100 months to alter our behaviour before we risk catastrophic climate change.*

**Prince Charles**

Rio de Janeiro  
13<sup>th</sup> March 2009

# Greenpeace View

The top of the slide features a green banner with the text 'Greenpeace View' in white. To the right of the text, there are decorative elements including a stylized green leaf, a yellow recycling symbol, and a cluster of green circles.

- **RSPO**

- Development too slow
- Existing rules not properly applied
- Even certified plantations break rules

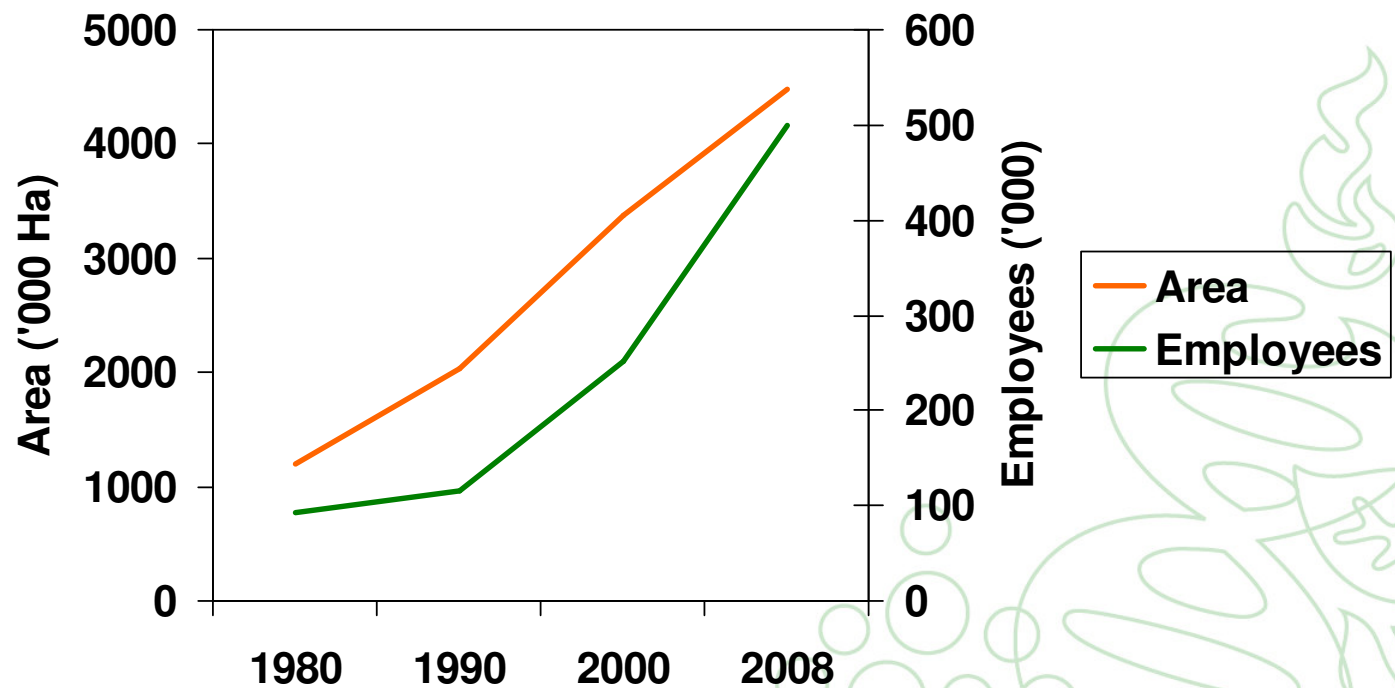
- **Concern that burning biodiesel produces more harmful emissions than conventional diesel**

- Prioritise palm oil for food production rather than fuel



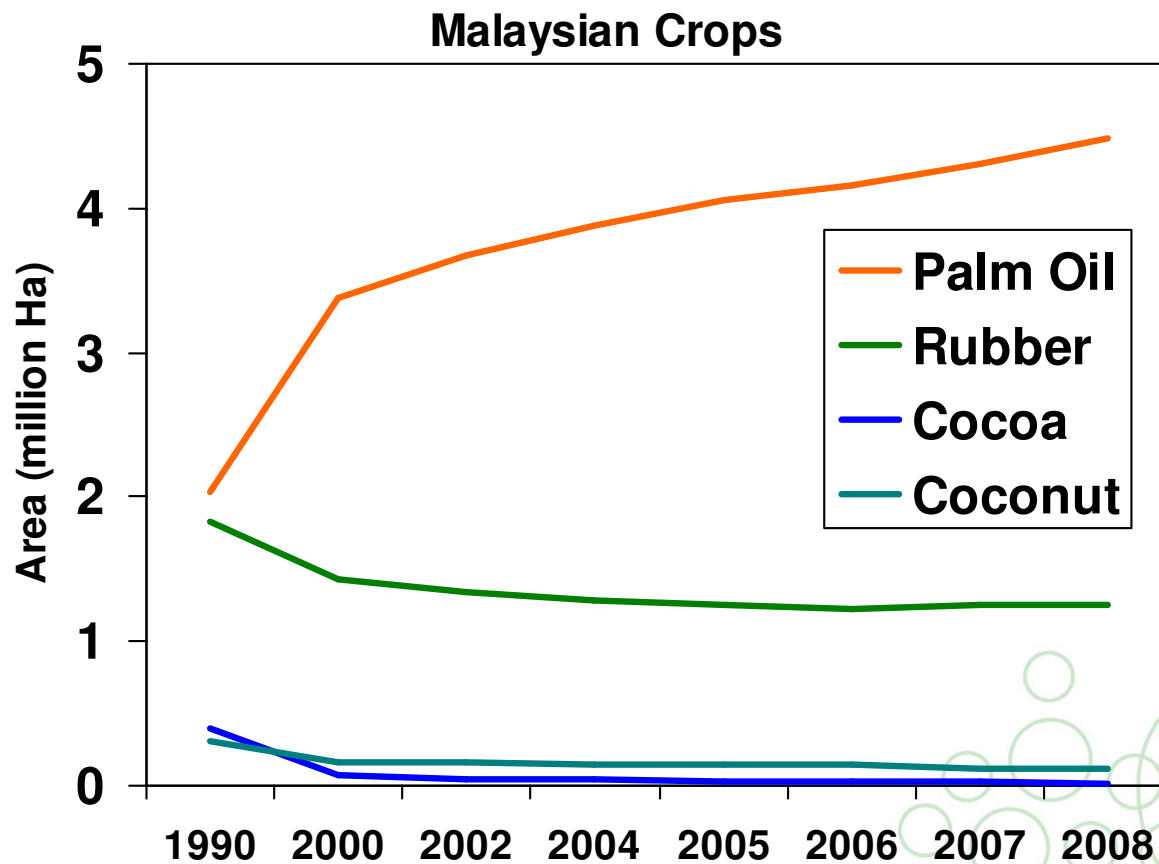
# People – Planet - Profit

- Palm plantations are a major source of employment
- Increase income
- Better housing
- Education



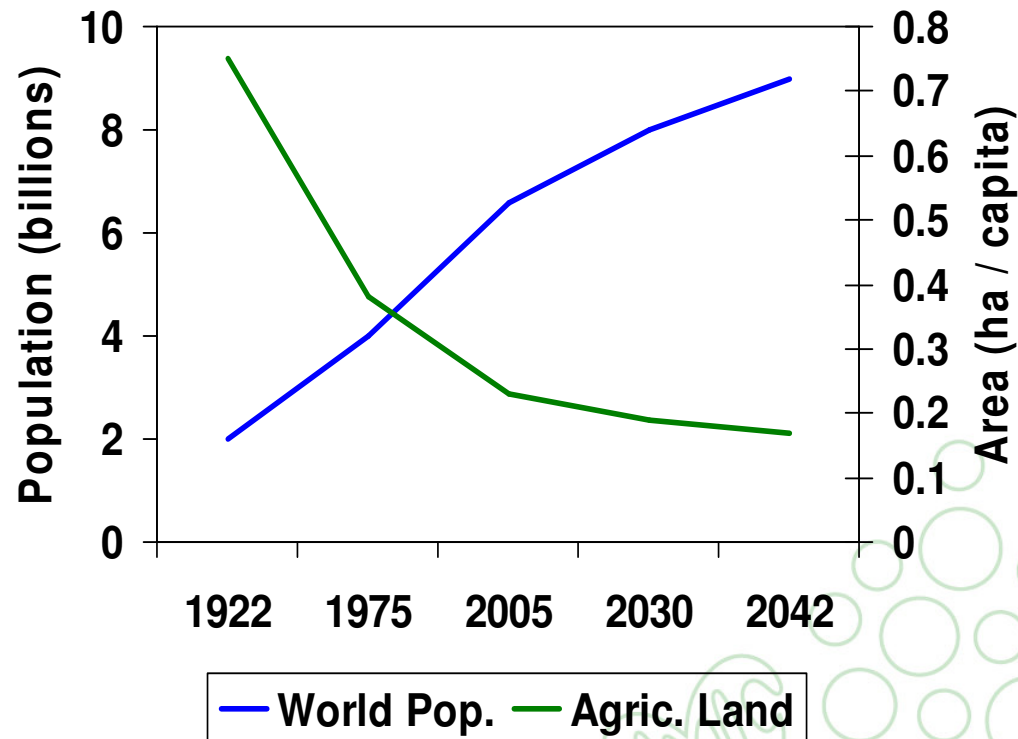
# People – Planet - Profit

- Palm not cultivated on designated forest reserves, etc.
- Often on land converted from other crops



# People – Planet - Profit

- **Brazil: conservation forest set aside with plantations**
  - Managed/maintain conservation areas
  - Wildlife surveys
- **Need to use land wisely**
  - 78.2 million ha of idle or under-utilised land in developing countries
    - Potential yield 288 million tonnes oil





# People – Planet - Profit

- Palm oil is highest yielding major oil crop

<b>Palm Oil</b>	<b>Soybean</b>	<b>Rapeseed</b>	<b>Sunflower</b>
<b>3.66</b>	<b>0.36</b>	<b>0.60</b>	<b>0.46</b>

- Palm oil more effective than soybean at reducing effect of global warming

	<b>Planted Area (million ha)</b>	<b>CO<sub>2</sub> Absorbed (t/ha)</b>	<b>O<sub>2</sub> Released (t/ha)</b>
<b>Palm Oil</b>	<b>9.24</b>	<b>29.3</b>	<b>21.3</b>
<b>Soybean</b>	<b>92.4</b>	<b>3.52</b>	<b>2.56</b>

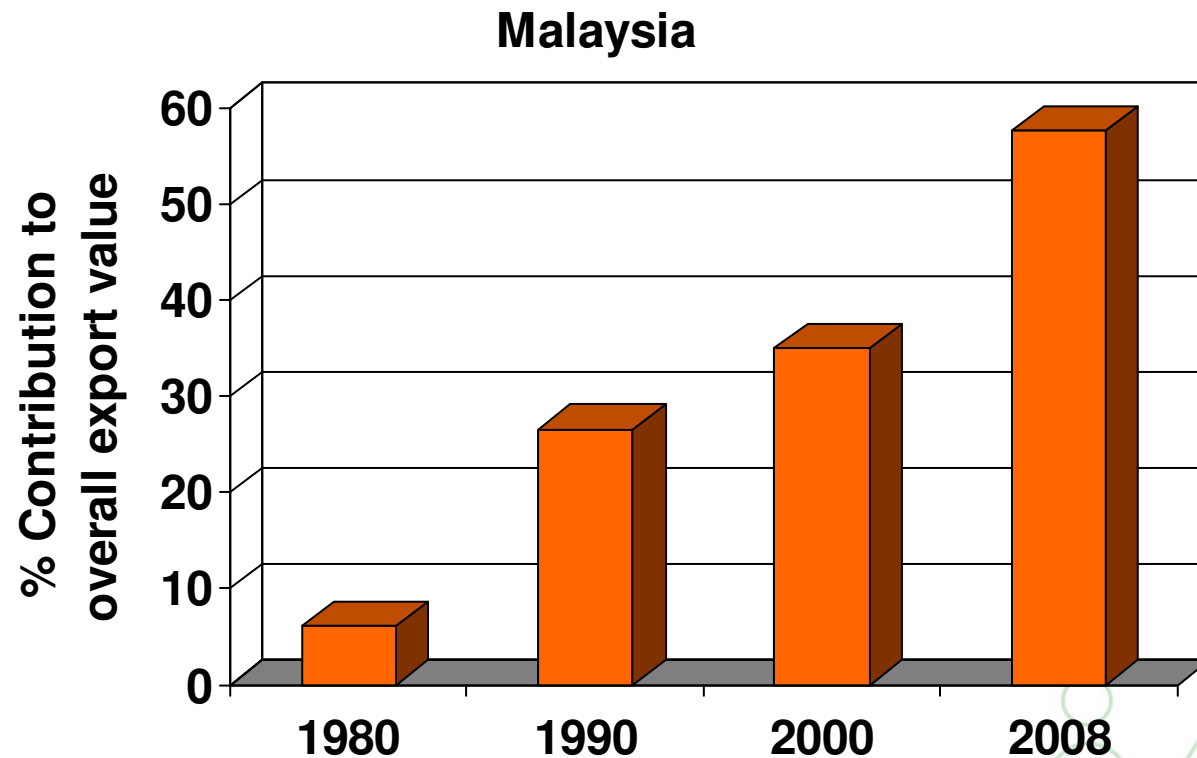
# People – Planet - Profit



- **Most countries have a regulatory framework controlling expansion of palm plantations**
    - Land (forest, peatland)
    - Environment
    - Wildlife
    - Employment
    - Endorse RSPO Principles & Criteria
  - **Training programmes for plantation managers**
    - RSPO
    - Sustainable principles & practices
- 

# People – Planet - Profit

- Contribution of palm oil to export value is increasing



# People – Planet - Profit

- **Indonesia assert right to develop**

	<b>Indonesia</b>	<b>Malaysia</b>	<b>UK</b>
<b>Population (million)</b>	<b>220.6</b>	<b>25.3</b>	<b>60.2</b>
<b>GNI/capita (\$)</b>	<b>1280</b>	<b>4970</b>	<b>37740</b>
<b>Land area ('000 sq km)</b>	<b>1811</b>	<b>329</b>	<b>242</b>
<b>Agric. land (% land)</b>	<b>26</b>	<b>24</b>	<b>70</b>
<b>Forest area (% land)</b>	<b>48.5</b>	<b>63.6</b>	<b>11.8</b>
<b>CO<sub>2</sub> emissions/capita (tonnes)</b>	<b>1.4</b>	<b>6.4</b>	<b>9.4</b>

# Life Cycle Assessment



## Parameters used:

- Energy consumption
- Global warming
- Acidification
- Eutrophication
- Photochemical smog
- Land use
- Others, less well-defined (e.g. biodiversity)

**Taking these into account, the major vegetable oils can be ranked from smallest to lowest impact:**

- Palm oil < soybean oil < rapeseed oil < sunflower oil
- 

# Summary



- **Palm Oil is the Sustainable 21<sup>st</sup> Century Oil**

- Greater yield per hectare than other oils
  - With potential to increase significantly
- Need to pursue ever stricter criteria for sustainability
- Large non-forested areas available for development
- Growth & processing have lower environmental impact than other oils
- Nutritionally positive
- Highly flexible food oil
- Most efficient oil for biofuel

