Palm Oil Practices in Thailand
1- Thailand Overview
Planted area of oil palms in Thailand

Source: DOA 2010

671,700 hectares
(1.66 million acres)

1969 First plantings at Univanich
1973 First factory at Univanich

Source: DOA 2010
Best Oil Palm Growing Regions

Best growing areas are within 10° of the equator.

Oil Palms are now spreading to dryer areas up to 15° from the Equator using drought tolerant hybrid seeds.
Key features: Thailand’s oil palms

- Small holders (less than 20 acres) comprise 80% of planted area.

- Land is being converted from other crops eg. rubber, coconuts, cattle grazing, rice padi. No clearing of primary forest.

- Shortage of labor encourages conversion to oil palm from rubber and other crops.
Production and uses of palm oil in Thailand

2010 Production: 1,288,000 tonnes CPO

- Cooking Oil (30.0%)
- Margarine shortening (5.0%)
- Food Industry (17.0%) (noodles, condensed milk, dairy creamer)
- Soap industry (2.0%)
- Animal Feeds (2.0%)
- Biodiesel (35.0%)
- Exported (9.0%)
## Thailand’s recent palm oil growth

<table>
<thead>
<tr>
<th></th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
<th>2011 F</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Planted hectares</strong></td>
<td>580,000</td>
<td>608,000</td>
<td>671,700</td>
<td>738,000</td>
</tr>
<tr>
<td>Acres</td>
<td>1.43 mil</td>
<td>1.50 mil</td>
<td>1.66 mil</td>
<td>1.82 mil</td>
</tr>
<tr>
<td><strong>CPO Production (million tonnes)</strong></td>
<td>1.54</td>
<td>1.35</td>
<td>1.29</td>
<td>1.60</td>
</tr>
</tbody>
</table>
Four factors driving growth in Thailand’s supply & demand

1- Domestic biodiesel policy is creating new demand

2- Oil Palm Breeding is improving drought tolerance

3- Irrigation Research is increasing crop yields

4- Energy policies are creating new investment opportunities
2- Univanich Company
**Univanich Business Structure**

- **Own Plantations**
  - 4 Estates
  - 6,200 ha (15,300 acres)

- **Univanich Oil Palm Research Centre**
  - Seedlings for replanting
  - Seedlings for new planting

- **Outside Growers**
  - approx 4,000 small growers
  - approx 40,000 ha (98,800 acres)

- **Seed Exports**
  - customers in 10 countries

- **Carbon Credits**
  - Target 100,000 CERs (in 2011)

- **3 Crushing mills**
  - (135 tonnes fruit per hour)
  - 17% Raw material
  - 150,000 tonnes FFB
  - 146,000 tonnes CPO
  - 21,500 tonnes PKO
  - 24,000 tonnes PKC

- **Electricity Sales**
  - Installed capacity for 5.7 Megawatts
  - 83% Raw material
  - 718,000 tonnes FFB

- **30% to 80% exported**
Development of export facilities at Krabi

Developing new overseas markets for Thai palm oil

In 2008 Univanich exported 151,000 mt CPO/PKO to Asia and Europe
Established in 1983

Univanich Oil Palm Research Centre (OPRC)

Thailand’s leading centre for oil palm research
Univanich OPRC has focus on sustainability;

- Economic sustainability
- Environmental sustainability
- Social sustainability
Research Activities;

- Oil Palm Breeding and Seed Production
- Fertilizer Trials
- Irrigation Research
- Planting Density Trials
- Methods of Replanting Trials
- Oil Palm Tissue Culture
- DNA Marker Research (with Kasetsart University)
- Methane Biogas Capture
- Round Table on Sustainable Palm Oil (RSPO)
Objective: To produce World Class Tenera hybrids suited to the dry growing conditions in Thailand.

Selections based on:

- High Oil Yields
- Drought Tolerance
- Low height increments
Univanich Collection of Genetic Material

Unilever & SIPEF
1968 Joint Research Scheme (JRS)
Binga (Congo)
Yangambi and other origins

Dami (Papua New Guinea)
(Harrison & Crosfield)
Deli Duras and AVROS

Combined Breeding Programme (CBP)
1988 - 1991

Lobe (Cameroon)
(Unilever)
Ekona and others

Chemara (Malaysia)
(Guthries)
Deli Duras, 1970

Unifield PLC (UK)
Clones of selected Duras, Teneras and Pisiferas, 1991

Univanich
Oil Palm Research Centre
Thailand

Yaligimba (Congo)
(Unilever)
Deli Duras, ex-Dami and others, 1997
Testing new hybrid crosses

Univanich progeny testing of more than 650 hybrid crosses
Producing a new generation of palms

Univanich DxP hybrid palm 24 months after planting
Producing a new generation of palms

Selected for high yields in Thailand’s dry climate
Seed Exports

Packing for Export
Certified ISO 9001 : 2000

Current production 10 million seeds

Univanich Oil Palms now growing in:

India
Myanmar
Cambodia
Vietnam
Philippines
Indonesia
Nigeria
Ethiopia
Colombia
Brazil
Also supplying local smallholders with top quality seedlings

Quality ISO 9001 : 2008 certification of Univanich nurseries
Supplying local farmers more than 1,000,000 seedlings each year
Univanich palms setting new records around Asia

High fruit yields and satisfied growers
Economic sustainability (continued)

Tissue Culture: the next innovation in oil palm breeding
Univanich Tissue Culture Laboratory

Producing Thailand’s first oil palm clones

Developing a new generation of high yielding oil palm clones
Cloning elite palms in the Univanich breeding programme
Economic sustainability (continued)

Irrigation research: to overcome the effects of Thailand’s dry seasons
## Monthly Soil Water Deficit (mm) in Krabi

<table>
<thead>
<tr>
<th>Jan</th>
<th>Feb</th>
<th>Mar</th>
<th>Apr</th>
<th>May</th>
<th>Jun</th>
<th>Jul</th>
<th>Aug</th>
<th>Sept</th>
<th>Oct</th>
<th>Nov</th>
<th>Dec</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>2004</td>
<td>25</td>
<td>94</td>
<td>94</td>
<td>26</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>15</td>
</tr>
<tr>
<td>2005</td>
<td>112</td>
<td>146</td>
<td>22</td>
<td>31</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>311</td>
</tr>
<tr>
<td>2006</td>
<td>0</td>
<td>0</td>
<td>5</td>
<td>36</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>49</td>
</tr>
<tr>
<td>2007</td>
<td>73</td>
<td>109</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>185</td>
</tr>
<tr>
<td>2008</td>
<td>41</td>
<td>24</td>
<td>3</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>2009</td>
<td>123</td>
<td>140</td>
<td>1</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>7</td>
</tr>
<tr>
<td>2010</td>
<td>43</td>
<td>76</td>
<td>98</td>
<td>37</td>
<td>22</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

Southern Thailand usually has four or five months of soil water deficit.
Automated irrigation trials to test (a) palm’s water requirements and (b) best methods of application
# Three Univanich Irrigation Trials 1990 - 2006

<table>
<thead>
<tr>
<th>Trial</th>
<th>Period</th>
<th>Objectives</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Drip Irrigation Trial</strong></td>
<td>1990 – 1999</td>
<td>To compare 150 litres/palm.day 300 litres/palm.day</td>
</tr>
<tr>
<td>(DIR 90)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Methods of Irrigation</strong></td>
<td>1996 – 1999</td>
<td>To compare 4 methods</td>
</tr>
<tr>
<td>(MIR 93)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Drippers</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Sprinklers</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Microsprayers</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Contour furrows</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Drip Irrigation Trial</strong></td>
<td>2000 – 2006</td>
<td>To compare 225 litres/palm.day 450 litres/palm.day</td>
</tr>
<tr>
<td>(Phase II)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## Summary of Irrigation Trial Yields
(old generation oil palms planted in 1985)

<table>
<thead>
<tr>
<th>Irrigation amount (litres/palm.day)</th>
<th>Normal Fertilizer</th>
<th>Double Fertilizer</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>17.6</td>
<td>18.2</td>
</tr>
<tr>
<td>225</td>
<td>24.3</td>
<td>24.1</td>
</tr>
<tr>
<td>450</td>
<td>25.0</td>
<td>28.1</td>
</tr>
</tbody>
</table>

Irrigation will increase yields by approximately 10 tonnes fruit per hectare

Oil palms responded to up to 450 litres/palm/day provided fertiliser was also increased
Yield Profile of new generation hybrid palms

FFB Yields of Univanich Hybrids

(Deli x Yangambi mixed commercial crosses planted in 1999)

Irrigation will add about 10 mt FFB per hectare
New generation hybrids with irrigation can produce up to 40 mt FFB per hectare
Developing sustainable replanting techniques
Developing new techniques for replanting old palms

Routine replanting of 3% to 4% of Univanich area each year
Terracing in hill estates

Developing environmentally sustainable planting practices to conserve moisture and protect the soil
New underplanting techniques on flat land

Phased felling of the old palms
New underplanting techniques on flat land

Underplanting spreads the economic cost of replanting and optimises use of biomass nutrients from the old stand of palms.
Underplanting trials at Univanich have indicated the potential for Integrated Cattle & Oil Palm: to diversify farmer income
Planting density and thinning trials
Normal planting density in Thailand
143 palms/hectare
Higher planting density of 160 palms/hectare with thinning to 120 palms/hectare.
High planting density of 180 palms/hectare with thinning to 120 palms/hectare
Planting density and thinning trials

- Univanich Research trials indicate that the best option is to plant at 160 palms/ha and to thin by 25% to 120 palms/ha in year 9 after planting.

- Up to year 16 this has given an additional 36 t FFB/ha compared to conventional 143 palms/ha.

Thinning of commercial 160 palms/ha (reduced to 140 palms/ha in 2007)
Empty fruit bunches (EFB) as substitute for chemical fertilizers
Nutrient equivalent of biomass replacing chemical fertilizers (kg equivalent)

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>P</th>
<th>K</th>
<th>Mg</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(SOA)</td>
<td>(GRP)</td>
<td>(MOP)</td>
<td>(Kieserite)</td>
</tr>
<tr>
<td>EFB 1 tonne</td>
<td>17.5</td>
<td>2.9</td>
<td>18.3</td>
<td>4.7</td>
</tr>
<tr>
<td>Trunks/hectare</td>
<td>1,616</td>
<td>92</td>
<td>707</td>
<td>281</td>
</tr>
<tr>
<td>at replanting</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fronds 1 tonne</td>
<td>52.1</td>
<td>5.6</td>
<td>15.9</td>
<td>11.2</td>
</tr>
<tr>
<td>annual pruning</td>
<td></td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>
Returning EFB biomass to the field

Reducing the need for chemical fertilizers
Mulching young palms with chipped old palm trunks at replanting

Conserving moisture, reducing chemical weeding
Recycling nutrients to the next generations
Frond stacking and EFB mulching under mature palms

Improving soil structure and moisture retention
Reducing soil and nutrient erosion
Methane capture and renewable energy from factory waste water

(POME – palm oil mill effluent)
Palm oil mill effluent (POME) is traditionally treated in deep anaerobic ponds which emit large quantities of methane biogas to the atmosphere.

A source of potent greenhouse gas emissions
### Three Univanich CDM Methane Biogas Projects

<table>
<thead>
<tr>
<th></th>
<th>Siam Project</th>
<th>Lamthap Project</th>
<th>Topi Project</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2007</td>
<td>2008</td>
<td>2009</td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
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</tbody>
</table>

**Total Capital Investment**: US$ 6.8 million
Construction of Biogas Reactors

First Project
2006/2007 - Univanich Siam Project

Second Project
2007 - Univanich Lamthap Project
Completed CIGARS®
(Covered In-Ground Anaerobic Reactors)

First Project - Siam
Commissioned December 2007

Second Project - Lamthap
Commissioned June 2008
Third Project
Commissioned August 2009

Capturing the methane emitted from factory waste water
Biological Scrubbers using bacteria to clean the gas

Horizontal Scrubber

Two designs of bio-scrubbers to reduce Hydrogen Sulphide from above 2,500 ppm to below 100 ppm

Vertical Scrubbers
Gas engine generators fueled by methane biogas supply electricity to the national grid.

Surplus biogas is burnt in flares to also qualify for Carbon Credits (CERs).
Increasing economic and environmental sustainability

Three biogas engine generators at the Topi palm oil mill
Biogas power houses are now attached to each Univanich factory

Supplying renewable electricity to Thailand’s national grid
<table>
<thead>
<tr>
<th></th>
<th>Siam Project</th>
<th>Lamthap Project</th>
<th>Topi Project</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electricity supplied to grid (MW hrs)</td>
<td>5,044</td>
<td>6,893</td>
<td>11,442</td>
<td>23,378</td>
</tr>
<tr>
<td>Sales value to grid (Baht) (Gross incl VAT)</td>
<td>16.3 mil</td>
<td>23.3 mil</td>
<td>37.2 mil</td>
<td>76.9 mil (US$ 2.5 mil)</td>
</tr>
<tr>
<td>Sales value to factory (Baht) (Gross incl VAT)</td>
<td>8.5 mil</td>
<td>5.1 mil</td>
<td>27.5 mil</td>
<td>41.2 mil (US$ 1.4 mil)</td>
</tr>
</tbody>
</table>
## Carbon Credits from Captured Methane
(12 months January – December 2010)

<table>
<thead>
<tr>
<th>Project</th>
<th>Estimated annual CERs (Certified Emission Reductions)</th>
<th>CERs received (to date) (since start of projects)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Siam Project</td>
<td>20,500</td>
<td>-</td>
</tr>
<tr>
<td>Lamthap Project</td>
<td>25,000</td>
<td>4,346</td>
</tr>
<tr>
<td>Topi Project</td>
<td>42,000</td>
<td>-</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>87,500</strong></td>
<td><strong>4,346</strong></td>
</tr>
</tbody>
</table>

The first POME biogas CERs to be issued to the Palm Oil Industry in Asia
Conclusions about Methane Capture Projects

1. The CIGAR® or modified covered lagoon technology is achieving our digestion and capture targets
   - the right choice of technology

2. The gas engines are mostly achieving generation targets
   - Supplying the electricity needs of more than 2,000 households around Krabi Province

3. CER revenue targets have not yet been achieved
   - the most difficult feature of all three projects
4. **Our environmental and sustainability objectives have been achieved**

- a large reduction of greenhouse gas emissions
- a renewable energy source has replaced fossil fuels
- waste water treatment has improved with reduced odours around the factories
- factory efficiencies have improved with reduced processing costs
- new skilled jobs have been created in three rural communities
- Sharing technology and creating new employment opportunities in rural areas
Creating good jobs and good housing for plantation workers and their families
Farmer Field Days at Univanich

Sponsored in co-operation with GIZ
Farmer Field Day at Univanich

More than 1,000 farmers attending Univanich field day
Farmer Field Day

Sharing results of Univanich research trials with local farmers
Extension Activities

New investors from other provinces visiting Univanich to study oil palm cultivation