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Coconut Research Institute (CRI) of Chinese Academy of Tropical Agricultural Sciences (CATAS)
Oct. 30, 2013
1. Brief Introduction

2. Research & Development of Coconuts

3. Current challenges
1. Brief Introduction

-Tropical Area in China

Area: 50,000,000 Ha.
Population: 170,000,000
Population for Agriculture: 100,000,000
Area: 50,000 Ha. for coconut
1. Brief Introduction of CRI, CATAS

- Location

CRI was established in 1980, located in the biggest coconut planting and processing city-Wenchang, in Hainan province.
1. Brief Introduction of CRI, CATAS

-Crops of interested

Coconuts

Oil Palm

Tea Oil Camellia

Betelnut
1. Brief Introduction of CRI, CATAS - Research Departments and Centers

Research Departments:
1. Department of Biotechnology Research
2. Department of Plant Protection Research
3. Department of Food Processing Research

Research Centers:
1. Center of Coconuts Research
2. Center of Oil Palm Research
3. Center of Tropical Speciality Crops Research
   (Tea Oil Camellia, Betel Palm, Peanut, Etc.)
1. Brief Introduction of CRI, CATAS
- Experimental and Demonstration Bases

- 240 Ha of scientific experimental base and plant genetic resource gardens of coconut, areca, oil palm and other palm plants
1. **Brief Introduction of CRI, CATAS**

- **Seedling and Breeding Base**

- 33.3 Ha of seedling breeding base have been established

- It is used for:
  
  1. Seed production by hybridization
  2. Seedling propagation and breeding
  3. Good varieties extension

![Coconut seedling](image1)
![Oil palm seedling](image2)
![Areca nut seeding](image3)
1. Brief Introduction

2. Research & Development of **Coconuts**

3. Current challenges
2. Research & Development of Coconuts

- Collecting, conservation and utilization of coconuts germplasm resources
- Breeding and selection of coconuts
- Technology development for high-yielding cultivation of coconuts
- Pests and diseases control
- Product processing and utilization of coconuts
- Natural product chemistry
- Oil chemistry
- Microbiology
- Quality and security control of the product
2. Research & Development of Coconuts
- Germplasm collection, conservation and utilization

Collection of Coconut and oil palm germplasm
- 71 coconut germplasm from the domestic
- 32 coconut germplasm from other country
2. Research & Development of Coconuts
   - Special germplasm collection
2. Research & Development of Coconuts
- RNA-seq analysis

<table>
<thead>
<tr>
<th></th>
<th>Number</th>
<th>Mean size</th>
<th>N50 size</th>
<th>Total nucleotides</th>
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<tr>
<td>Read</td>
<td>54,931,406</td>
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<td>90</td>
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3. Research & Development of Oil palm

- Coconut molecular markers development

Distribution of SSR loci on Unigene

Polymorphism of SSR

SSR contained Unigene annotation
2. Research & Development of Coconuts
   - Molecular marker and germplasm evaluation

Electrophoresis diagram of DNA extracted from Coconut germplasm in part

Evaluation of these coconut germplasm

The SSR assay from 42 coconut germplasm

2. Research & Development of Coconuts
- Molecular marker and application

Aromatic coconut (with aromatic smell)  Aromatic coconut (without aromatic smell)
2. Research & Development of Coconuts - Breeding and Selection

- Screen for germplasm with cold resistance
- Screen for germplasm with early flowering time
- Screen for high-yield germplasm

Wenye #2

Wenye #3

Wenye #4

Wenye78F1-a crossing of Wenye#2♀ and Hainnan Tall ♂
2. Research & Development of Coconuts
- Technology development for high-yielding cultivation

Interplanting in coconut plantation and raising
## 2. Research & Development of Coconuts
- Technology development for high-yielding cultivation

### Income analysis of coconut garden with intercropping for 3 years (yuan/hm²)

<table>
<thead>
<tr>
<th></th>
<th>item</th>
<th>control</th>
<th>Coconut–pineapple</th>
<th>Coconut–papaya</th>
<th>Coconut–watermelon</th>
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<tbody>
<tr>
<td>input</td>
<td>total</td>
<td>total</td>
<td>total</td>
<td>total</td>
<td>total</td>
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<tr>
<td></td>
<td>Seedling costs</td>
<td>0</td>
<td>4500</td>
<td>5250</td>
<td>24700</td>
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<td></td>
<td>Fertilizer costs</td>
<td>0</td>
<td>16400</td>
<td>31355</td>
<td>53610</td>
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<td>Pesticide costs</td>
<td>1150</td>
<td>1650</td>
<td>6180</td>
<td>19420</td>
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<td>Management costs</td>
<td>12600</td>
<td>6300</td>
<td>12600</td>
<td>37800</td>
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<tr>
<td></td>
<td>total</td>
<td>13750</td>
<td>28850</td>
<td>55385</td>
<td>135530</td>
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<tr>
<td>output</td>
<td>total</td>
<td>13750</td>
<td>12805</td>
<td>63500</td>
<td>115670</td>
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</table>

*In a period of three years, intercropping watermelon had the highest income with an average of 38,000 yuan per hectare per year.*
## 2. Research & Development of Coconuts
- Technology development for high-yielding cultivation

### Coconut garden with chicken

<table>
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<th>treatment</th>
<th>input</th>
<th>output</th>
<th>Net income</th>
</tr>
</thead>
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<tr>
<td></td>
<td>coconut</td>
<td>chicken</td>
<td>total</td>
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<tr>
<td>None management coconut garden</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2004</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>2005</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>2006</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Total</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Normal management coconut garden</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2004</td>
<td>7350</td>
<td>0</td>
<td>7350</td>
</tr>
<tr>
<td>2005</td>
<td>7350</td>
<td>0</td>
<td>7350</td>
</tr>
<tr>
<td>2006</td>
<td>7350</td>
<td>0</td>
<td>7350</td>
</tr>
<tr>
<td>Total</td>
<td>22050</td>
<td>0</td>
<td>22050</td>
</tr>
<tr>
<td>Coconut garden of feeding chicken</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2004</td>
<td>0</td>
<td>217500</td>
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<tr>
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<td>0</td>
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<td>217500</td>
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<tr>
<td>Total</td>
<td>0</td>
<td>652500</td>
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</tr>
</tbody>
</table>

*Raising chicken in the coconut garden can increase the benefit with average profit is about 50,000 yuan/hm² in one year*
2. Research & Development of Coconuts - Coconut pests and diseases control

1) Coconut Leaf Beetle (CLB), *Brontispa longissima*

- Adult Beetles
- Affected coconut
- Egg
- Larva
- Affected arecanut
2. Research & Development of Coconuts
- Coconut pests and diseases control

- Current research focus

  - Biological control of Coconut Leaf Beetle (CLB), *Brontispa longissima*

    CLB is one of the most serious insect pests of coconut and ornamental palm plants in many tropical areas. Seventeen species of palm trees including oil palm, nipa palm and many ornamentals can be attacked.

  - Hanging insecticide bags on infested palms.
Two biological agents, *Asecodes hispinarum* and *Tetrastichus brontispae* were introduced to China and applied to control CLB

Promising results have been obtained and they have been used in a large scale
2. **Research & Development of Coconuts**

- **Coconut pests and diseases control**
2. Research & Development of Coconuts - Coconut pests and diseases control

2) Red Palm Weevil (RPW), *Rhynchophorus ferrugineus*

- RPW is the most serious pest of coconut and other oil palm plants in the world. Sustainable control methods including pheromone trapping and sounding methodology detection were utilized.
2. Research & Development of Coconuts
   - Coconut pests and diseases control

- **Sustainable control methods**

  Insect trapping equipment (plastic bucket and bag) every 20 trees. Insert been trapped each day.

  Special scents to attract the insect.
2. Research & Development of Coconuts - Coconut pests and diseases control

3. Coconut Stem Bleeding (CSB)
2. Research & Development of Coconuts
   - Food processing-Coconut

- Mainly research on
  - Improvement of wet processing technology of coconut
  - Products development of coconut
  - Functional properties of tropical oil crops and palm plants
  - Collection and utilization of coconut inflorescence sap
  - Formulation of product standard
Chemical composition changes of post-harvest coconut inflorescence sap during natural fermentation
2. Research & Development of Coconuts
- Coconut products development
2. **Research & Development of Coconuts**

- Coconut products development

![Coconut Wine](image1)

![Virgin Coconut Oil](image2)

![Coconut Sugar](image3)

![Coconut Powder](image4)
2. Research & Development of Coconuts
   - Coconut products development

Coconut sap products
Outline

1. Brief Introduction
2. Research & Development of Coconuts
3. Current challenges
3. Current challenges

1). In China, currently about 90% of planted coconuts are Hainan Tall and most of them are as it in the natural habitat without any managements. The system gives very low output and therefore makes the land used inefficient. The coconut tree will produce less than 30 nuts per tree per years in average, and it is about 4500 Yuan/Ha which is much lower than other tropical crops.

2). Since most tropic areas in China are located in the north margin of tropical zone, cold damage for coconut tree is still a problem during the winter. The lack of cold resistance variety was also limit the expansion of coconut plantation to south of the sub-tropical area.
3). With the nature of the long generation time for coconut, the classical breeding is inefficient for coconut breeding in the way. Seednuts harvested of the hybrids do not give the same hybrids were happened frequently. Impure seedlings were released to the farmer and cause the significant loss for the farmer after years of input. Molecular marker base rapid screen technologies development are still underway, and is much leg behind the demand.

4). Most of the goods from coconut are low end products and the market share is still very small. Although the market potential is very high in China, much effect is still need to take to push it forward.
Contact Information

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Thank You