



Research & Development of Coconut in China



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(CATAS)**

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Outline



1. Brief Introduction



2. Research & Development of **Coconuts**

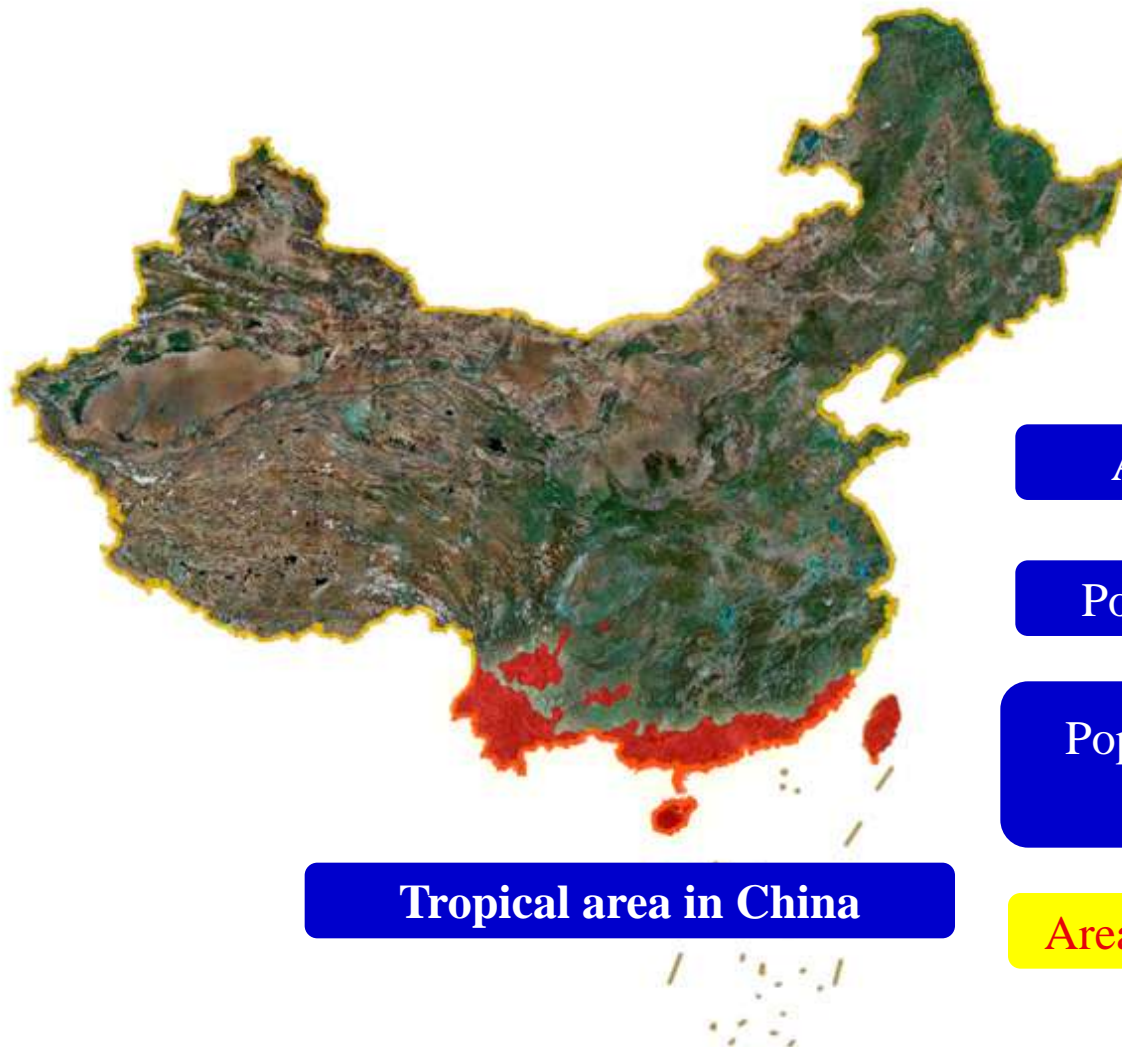


3. Current challenges



1. Brief Introduction

-Tropical Area in China



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



Haiko City

Wenchang City

Hainan Island



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.)



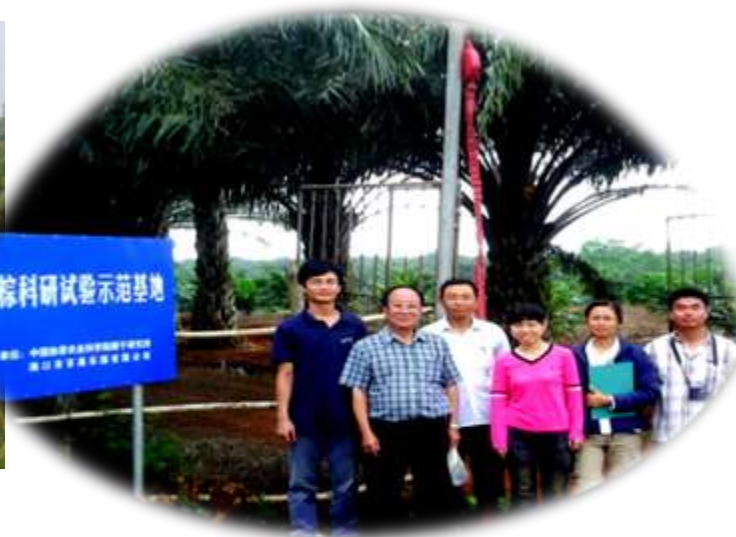


1. Brief Introduction of CRI, CATAS -Experimental and Demonstration Bases

- 240 Ha of scientific experimental base and plant genetic resource gardens of coconut, areca, oil palm and other palm plants



Coconut



Oil palm

Areca





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



Oil palm seedling



Arecanut seedling



Outline



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**

Germplasm Resources and Genetic Breeding

Plants cultivation

Plants protection

Food processing

Industrial economy



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



Protection for important germplasm resource

Coconut germplasm nursery





2. Research & Development of Coconuts

- Special germplasm collection

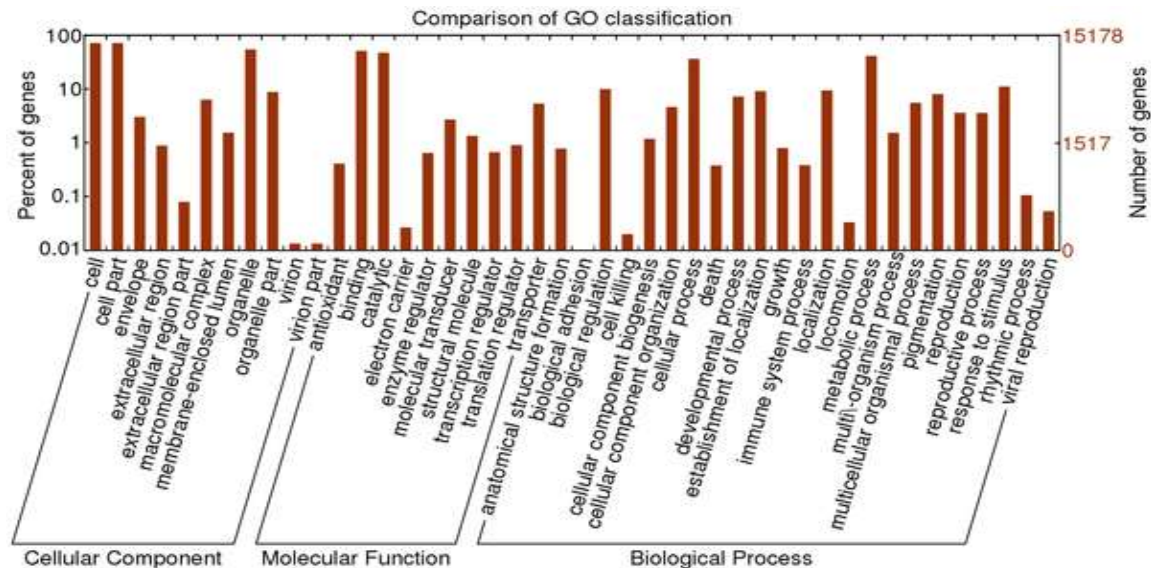




2. Research & Development of Coconuts - RNA-seq analysis

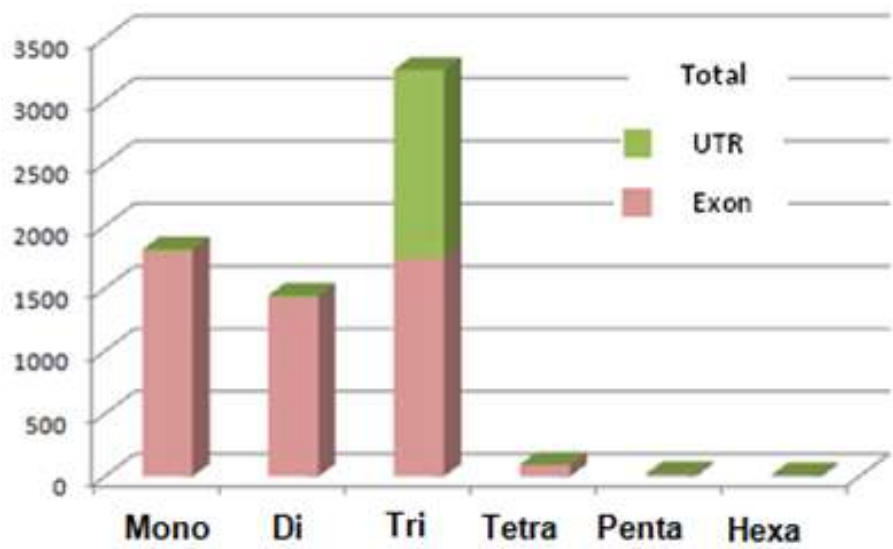
	Number	Mean size	N50 size	Total nucleotides
Read	54,931,406	90	90	4,943,826,540
Contig	127,952	344	594	43,994,141
Unigene	57,304	752	1,219	43,090,665

doi:10.1371/journal.pone.0059997.t001

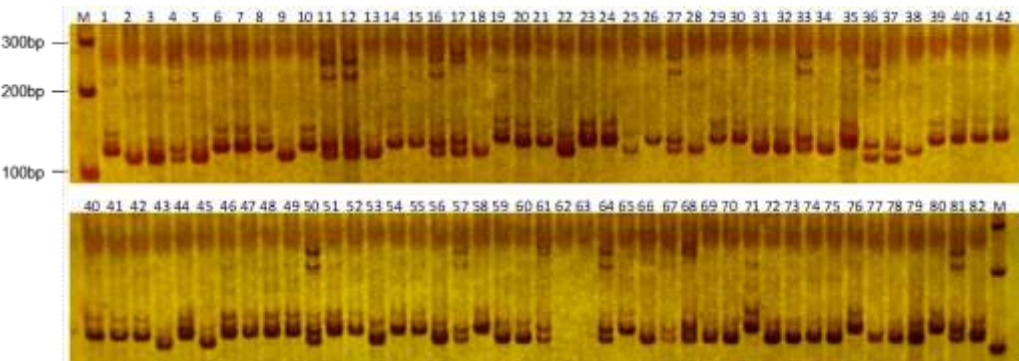




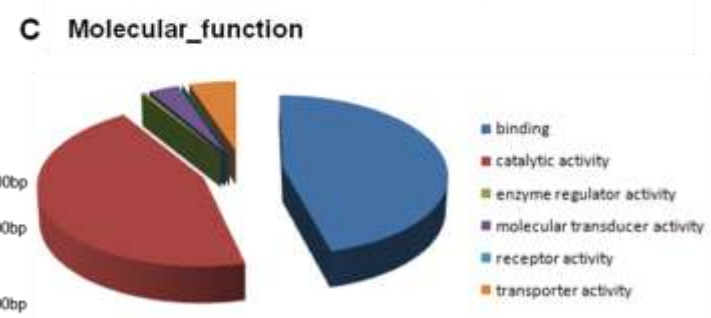
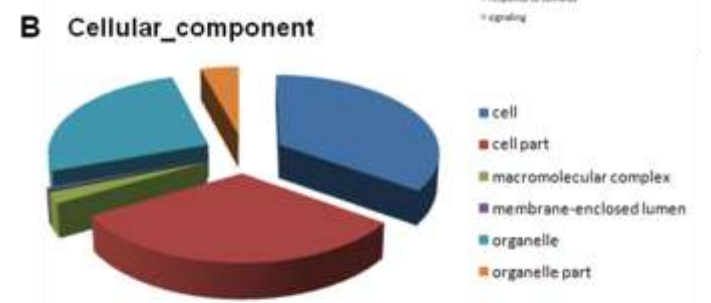
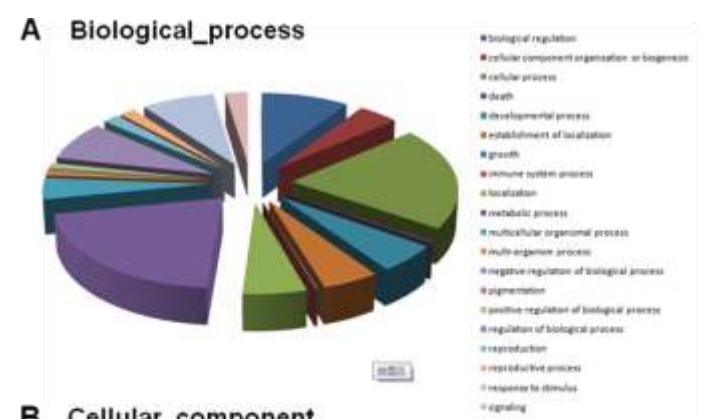
3. Research & Development of Oil palm -Coconut molecular markers development



Distribution of SSR loci on Unigene



Polymorphism of SSR

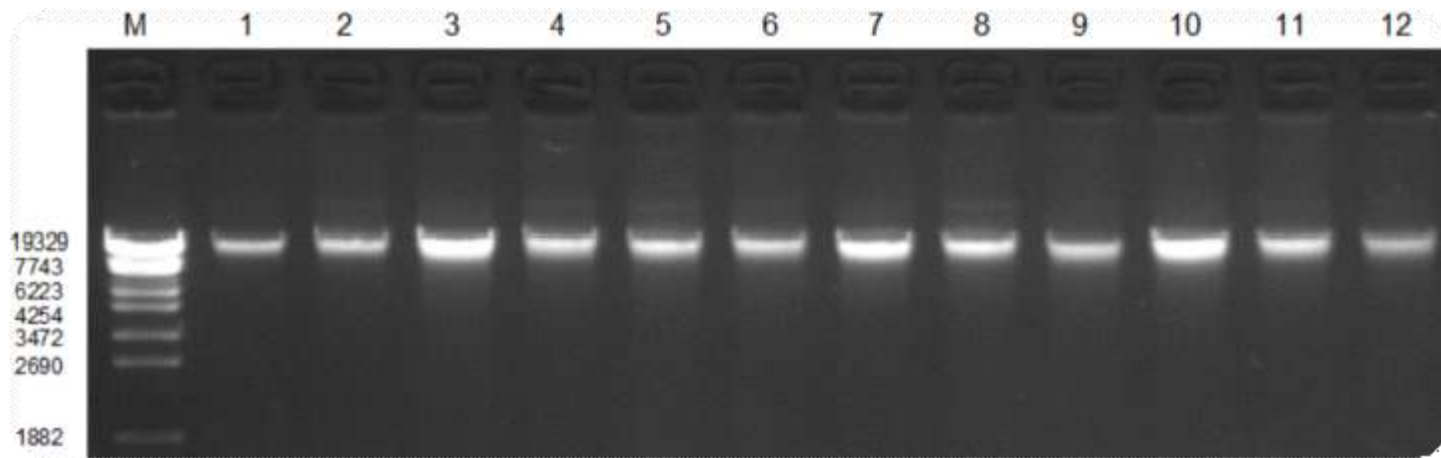


SSR contained Unigene annotation



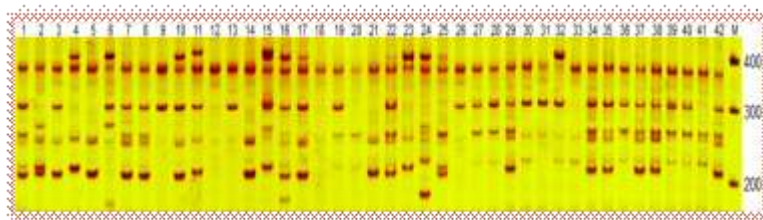
2. Research & Development of Coconuts

- Molecular marker and germplasm evaluation

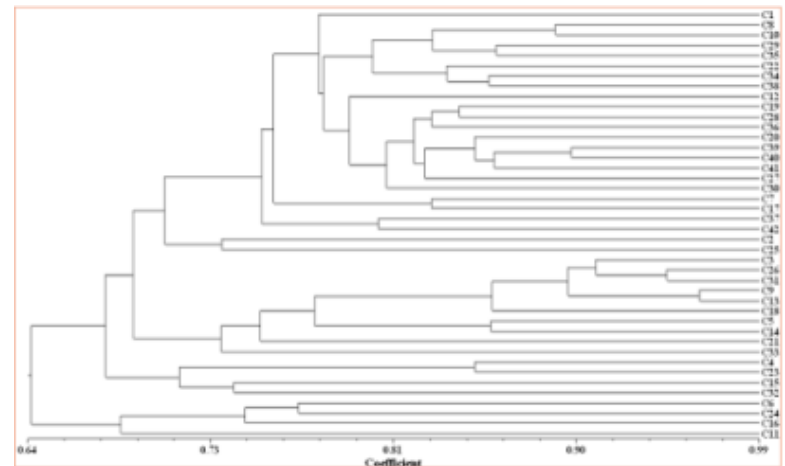


Electrophoresis diagram of DNA extracted from Coconut germplasm in part

Evaluation of these coconut germplasm



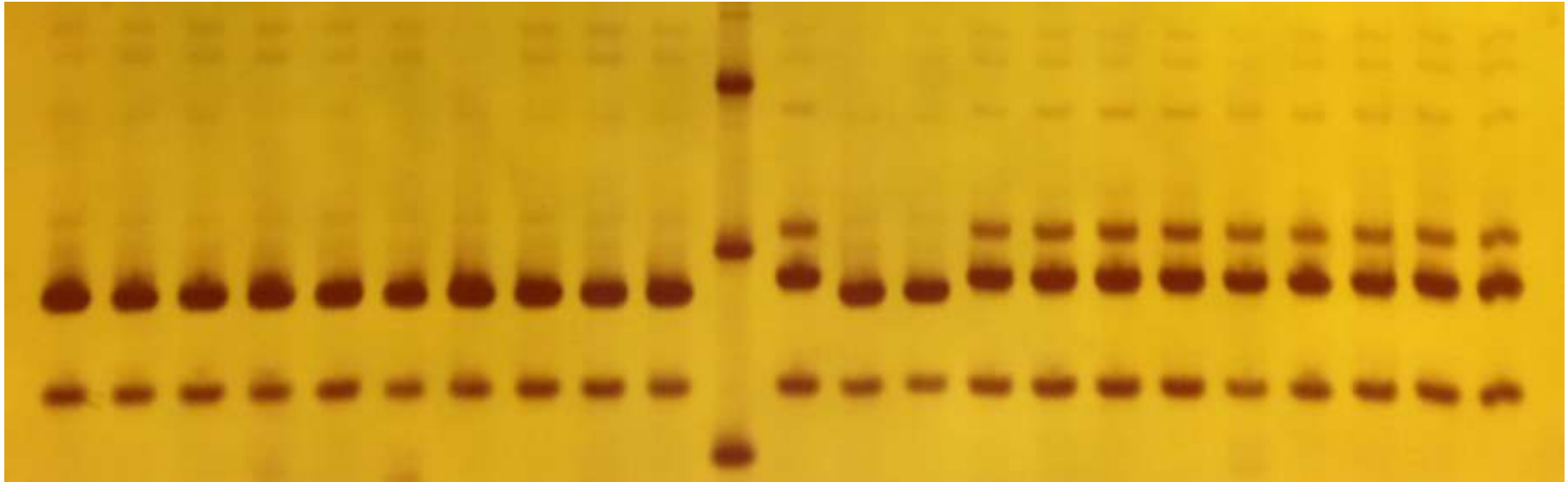
The SSR assay from 42 coconut germplasm





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

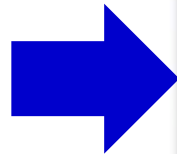


Wenye78F1-a crossing of
Wenye#2 ♀ and Hainnan Tall ♂



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 3years (yuan/hm²)

item		control	Coconut- pineapple	Coconut-papaya	Coconut- watermelon
		total	total	total	total
input	Seedling costs	0	4500	5250	24700
	Fertilizer costs	0	16400	31355	53610
	Pesticide costs	1150	1650	6180	19420
	Management costs	12600	6300	12600	37800
	total	13750	28850	55385	135530
output		0	41655	118885	251200
income		-13750	12805	63500	115670

*In a period of three years, intercropping watermelon had the highest income with average of 38,000 yuan per hectare per year



2. Research & Development of Coconuts

- Technology development for high-yielding cultivation

Coconut garden with chicken

treatment		input			output			Net income
		coconut	chicken	total	Coconut	chicken	total	
None management coconut garden	2004	0	0	0	12222	0	12222.0	12222.0
	2005	0	0	0	10458	0	10458.0	10458.0
	2006	0	0	0	7717.5	0	7717.5	7717.5
	Total	0	0	0	30397.5	0	30397.5	30397.5
Normal management coconut garden	2004	7350	0	7350	14017.5	0	14017.5	6667.5
	2005	7350	0	7350	17829	0	17829.0	10479
	2006	7350	0	7350	24066	0	24066.0	16716
	Total	22050	0	22050	55912.5	0	55912.5	33862.5
Coconut garden of feeding chicken	2004	0	217500	217500	13041	247500	260541	43041.0
	2005	0	217500	217500	17136	247500	264636	47136.0
	2006	0	217500	217500	25263	247500	272763	55263.0
	Total	0	652500	652500	55440	742500	797940	145440.0

*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.**



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

- 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



Asecodes hispinarum



Tetrastichus brontispae



Attack the larva



Parasitoid Rearing Workshop



Parasitoid Releasing





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



Before release



After release





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

RPW adults



Mature larva



Damage to *Cocos nucifera*





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

- **Sustainable control methods**

Insect trapping equipment (plastic bucket and bag) every 10 trees.



Special scents to attract the insect

Insect been trapped each day.

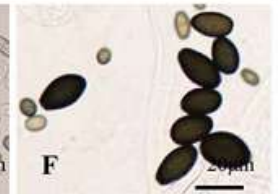
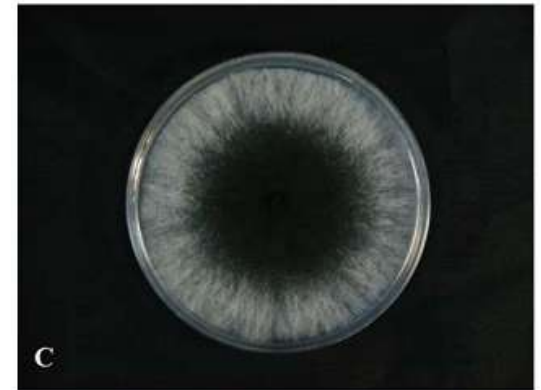


Sounding methodology detection



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**



2. Research & Development of Coconuts - Inflorescence sap collection

Collection of
coconut sap



Binding spathe



Cleavage spathe



The sap effuses from the spathe



Collection sap

Chemical composition changes of post-harvest coconut inflorescence sap during natural fermentation
Qiuyu Xia, Rui Li, Songlin Zhao, *et al.* African Journal of Biotechnology, 2011



2. Research & Development of Coconuts - Coconut products development



Corn coconut oil

Olive coconut oil

Sunflower coconut oil

Oil tea coconut oil



Virgin coconut oil



2. Research & Development of Coconuts - Coconut products development

Coconut Wine



Virgin
Coconut
Oil



Coconut Sugar



Coconut
Powder





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. Current challenges

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.



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An aerial photograph of a tropical golf course. The scene is dominated by a dense forest of tall palm trees. In the center, a large, well-maintained green field, likely a fairway or green, is visible. To the left, a small body of water, possibly a pond or a lake, is partially obscured by trees. The overall atmosphere is lush and serene, typical of a tropical resort.

Thank You