HLB Control and OJ quality
Characteristics and Safety in China

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Agenda

- Citrus industry in China
- HLB control in China
- Orange juice characteristic in China
Citrus planting area was 0.274 m ha that produced 0.798 m t in 1981; the area increased to 2.42 m ha that produced 33.21 m t in 2013, so planting area increased 8.8 times and output increased 41.6 times in China in past 33 years. 

Source: Chinese MoA
China main citrus provinces in 2013 (Output)

Source: Chinese MoA
China Main citrus provinces in 2013 (planting Area)

1000 ha

Source: Chinese MoA
China Main citrus varieties in 2013 (By output)

- Mandarin & Tangerin: 68%
- Orange: 19%
- Pummelo: 11%
- Others: 2%

Source: Chinese MoA
Citrus Fruit Utilization in China

- 95% for fresh market
  - 60% treated with packing line
  - 35% simply packed for free market
- 5% for processing
  - 2% processed into mandarin section
  - 2% processed into juices
  - 1% processed into candies

Source: personal statistics
Main Citrus processing plants

Cha Meei Food Indl. Co

Summi Food Co and Tianyi Ltd

Huivaun Juice Group

Hunan Liwen Canning Food Co.
Mandarin Section Production

Peeling

Sorting

Canning

Seelling
OJ products made in China
Mandarin Section Products made in China
Outlook of citrus industry in China

- China citrus industry will keep the present scale of 2.4 m ha planting area and 35 m tons annually.
- The domestic fresh market will still be the main direction, sweet orange and hybrid mandarin will increase share, OJ consumption will continue growing.
- China citrus industry would take place great change when the land could be free trading.
Citrus HLB was first discovered in the Chaoshan area of Guangdong province in the early twentieth century. It was described as yellow mosaic symptoms in 1919. A peak incidence occurred in Guangdong, Fujian in 1930, after every 20 - 30 years there will be a peak of incidence. Since 2010 a peak incidence has appeared in Guangxi, Guangdong and Jiangxi, more than 30 m trees infected were destroyed in Jiangxi. The Ministry of Agriculture and the management departments at all levels attach great importance to HLB prevention and it is under control now.
Distribution of Huanglongbing

- HLB moving northward

- 70年代以前发现的黄龙病流行区
  Prevailing area found before 1970's

- 70年代或70年代以后发现的黄龙病流行区
  Prevailing area found in 1970's or after 1970's
Pathogens – bacteria-like

Identified in 1984

Three types:

- *Candidatus Liberobacter asiaticus*
- Ca. *Liberobacter africanus*
- Ca. *Liberobacter americanus*
Transmission by

- **Scion-graft**
- **Nursery trees**
- **Psyllids (Major way)**
  - *Diaphorina citri* Kuwayama
  - *Trioza erytreae* Del Guercio
  - *Cacopsylla citrisuga*

Eggs and 1st instar nymph not infected, about 2/3 of the 4th - 5th instar nymphs infected
Adult Psyllids
Yellow shoots, mottled leaves and red nose fruit are the major symptom of HLB
Red nose fruit infected
Occurrence regular pattern

- High latitude, high altitude groves less HLB
- Low land and shade groves less HLB
- Poor tree care groves spread more quickly
- Replanted trees in severe infected groves outbreak in 1–2 years
- Newly planted groves in 3～4 years less incidence, once the HLB is not controlled in time, it spread rapidly
- Phototaxis of psyllids is strong, easy to produce edge effects
More HLB at lowland

Edge effects
China uses "Four Choppers" against HLB

- Apply diseases-free trees
- Remove infected trees
- Quarantine
- Control psyllids

Reduce pathogens
Prevent spread
Seminar to control HLB in Guilin in June of 2009

MoA organized HLB prevention meeting in Guangxi in April of 2010

MoA organized HLB prevention meeting in Guilin in June of 2014
HLB control meetings in spread area

In Guangdong in Nov. of 2011
In Jiangxi in July of 2012
In Fujiang in Oct. of 2012
In Jiangxi in June of 2014
HLB control field training

- Training famers to diagnose HLB
- Training famers to control HLB
- Training famers to kill psyllids
- Training famers to diagnose HLB at field
Apply bacteria-free trees produced in Screen / greenhouse

- Rootstock seeds sowing
- Rootstock seedlings
- Taking HLB free scion
- HLB free grafted trees
Cutting and burning the trees infected HLB
Quarantine staffs are burning the trees got from HLB area
Killing psyllids in time

Smoke prevention psyllids
1600 acres of 18 years old Navel orange trees in Lingchuan, Guangxi using “4 choppers” to prevent HLB, has kept high yield with 740 boxes per acre.

1000 acres of 15 years old Shatang tangerine trees in Cangwu, Guangxi using “4 choppers” to prevent HLB, has kept high yield with 740 boxes per acre.
China citrus industry has developed under against HLB, so we have strong organization at all level to control HLB

HLB control is quite rely on the economic benefits, grovers have higher enthusiasm when fruiting income is higher than the costs of HLB control

New technology development will improve HLB control
CRI cooperated with SGF International e.V. (SGF)

- Evaluated the quality and authenticity of the orange juice produced in China following the Reference and Guideline for Orange Juice made by European Fruit Juice Association (AIJN), including 13 absolute quality requirements and 70 criteria of authenticity, while the 20 kinds of pesticide residues was tested also.

- 81 samples (42 SSJ and 39 CJ) were collected on line from six major OJ processing plants and one pilot plant of CRI in the past three years from 2011 to 2014.

- Sampling methods were in accordance with the provisions of SGF, collected the samples produced in early, middle and late seasons, respectively.
CRI signed an agreement with SGF on October 26, 2011
Taking the samples on line of plants
Taking samples from the pilot plant of CRI
Evaluation of absolute requirements of OJ made in China

- The quality of OJ samples is basically in line with absolute requirements of AIJN, but citric acid content of some samples is high, which resulting low solid-acid ratio. Only four COJ samples exceeded that of lactic acid content, which may be caused by improper processing or storage.

- Vc of COJ is generally higher than that of SSOJ, maybe due to improper sterilization, packaging and storage.
Most of the index of 81 orange juice samples detected meet the AIJN reference requirements;

Hesperidin level of 38% samples is higher than the AIJN reference upper limit value 700mg / l, the highest content of 1503mg / l is more than 2 times of the upper limit. China State Standard GB / T 16771 stipulated total flavonoids in orange juice (mainly hesperidin) is 1185 mg / kg; the average level of hesperidin from 200 samples in nationwide is 1298mg / kg. Therefore, hesperidin in OJ made in China is higher than AIJN value.

Water-soluble pectin content of 43% samples is lower than 200 mg / l, the AIJN minimum limit, that need for further verification.

Cryptoxanthin esters of 52% samples exceed the AIJN upper limit of total carotene, indicating that Chinese OJ has deeper color
Evaluation of Chinese OJ safety

- Only five kinds of pesticide residue were detected in four samples from 1660 pesticide residues index measured of 81 samples, two of them exceeded the Europe limit of the pesticide residues a little bit, so Chinese OJ is in general safe.

- 4 samples having exceeded pesticide residue may be caused by the illegal use of pesticides in tree care procedure, therefore, the basic method to prevent pesticide overrun is in accordance with national and international regulations to ensure their proper use. In addition, it can strengthen the fruit surface cleaning with compliance alkali detergent, hypochlorous acid, bromine oxygen or/and other fruit cleaningin
Chinese OJ quality and safety review

- Being basically in line with EU quality standards
- Flavonoids and color components having higher levels
- High acid content of existing raw materials resulting low ratio orange juice
- Being good safety
Thanks for your attention!