Meeting the Challenge of the Asian Citrus Psyllid in California Nurseries
A two-day workshop in Riverside, California
June 11–12, 2009

Invited Speakers:
J. Ayres-Fundecitrus, Brazil
J. Bethke-UC, CA
G. Baze-Golden Pacific Structures, CA
T. Delfino-CCNS, CA
F. Dixon-Wells Fargo, CA
D. Elder-American Ag Credit, CA
T. Gast-Southern Gardens Citrus, FL
P. Gomes-CHRP, USDA-APHIS, NC
E. Grafton-Cardwell-UCR, CA
D. Howard-AgraTech, CA
N. Jameson-Brite Leaf Nursery, FL
R. Keijzer-KUBO, The Netherlands
P. Llatser-AVASA, Spain
S. McCarthy-CDFA, CA
G. Vidalakis-UCR-CCPP, CA

Organizing Committee:
T. Delfino-California Citrus Nursery Society
A. Eskalen-Dept. of Plant Pathology & Microbiology, University of California Riverside
R. Lee-USDA-ARS, National Clonal Germplasm Repository for Citrus and Dates
G. Vidalakis-Citrus Clonal Protection Program, Dept. of Plant Pathology & Microbiology, University of California Riverside

Registration: http://ccpp.ucr.edu & http://eskalenlab.ucr.edu

Location:
Sunkist Center
Citrus State Historical Park
9400 Dufferin Avenue
(Corner of Van Buren Blvd)
Riverside, California

Sponsored by:

Information on line at: http://eskalenlab.ucr.edu
Citrus nursery Certification in Spain (1968-2008)
AVASA, Foundation and certified budwood production under natural isolation and protective screen

Francisco Llatser
Technical Manager
Agrupación de Viveristas de Agrios, S.A.
AVASA®
Historical review of the Spanish Citrus Industry

• 15th & 16th century
  - Introduction of the first citrus, from Asia through the North of Africa.
  - Distribution in the Americas, by the first Spanish explorers and missionaries

• 18th century
  - Beginning of the commercial citrus expansion in Spain. Exports to U.K.

• 19th century
  - Citrus varieties: Common oranges, mandarins and blood oranges. Seedy fruits
  - Rootstocks: Sweet orange and Common mandarin
  - 1862: Detection of the Phytophthora sp disease

• 20th century
  - 1909: Introduction of the variety Washington navel (Bahia) from U.S.A.
  - 1930-1935: CTV was introduced in Valencia, probably with propagation materials imported from California
  - 1957: 1st epidemic CTV outbreak, after the severe frost in Valencia (1956)
20-21th century

- Thousands of nurserymen use sour orange (Citrus aurantium), as rootstock. Low quality nursery trees

- 1958-1972: Legislative regulations for the nursery sector

- 1968: The first 9 Authorized Nurseries are created

- 1972: Supplying of the first 500,000 citrus plants of the Certification program. Rootstocks tolerant to CTV

- 1975: Citrus improvement program in Spain

- 1976: AVASA was created by association of the 9 authorized nurseries

- 1979: ELISA / CTV application

- 1982-84 Obtention, patent and release of monoclonal antibodies for CTV detection (INGENASA – IVIA)
- 1.983: National quarantine station in Valencia
- 1.994: Commercialization of CTV detection Kits by Tissue Print ELISA
- 1.996: AVASA Foundation Block and Increases Blocks protected under screenhouses. CTV analysis individual, tree by tree
- 2.008: More than 150 million of certified citrus plants grafted on CTV tolerant roostocks
- Increase of the production and the quatility of plants and fruits
- Spain became the first world-wide exporter of citrus fresh fruit and the first world producer of clementines.
The Spanish citrus industry today

- Acreage: 330,000 ha. (730,000 acres)
- Production: 6,5 million M.T.
  - 4th world citrus producer
  - 1st world fresh fruit exporter (55%)
  - 54% Sweet oranges, 34% Mandarins (23% Clementines), 11% Lemons, 1% Grapefruits
### SPAIN: Citrus crops evolution 1991/92-2008/09 (1,000 MT)

<table>
<thead>
<tr>
<th></th>
<th>91/92</th>
<th>92/93</th>
<th>93/94</th>
<th>94/95</th>
<th>95/96</th>
<th>96/97</th>
<th>97/98</th>
<th>98/99</th>
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<th>04/05</th>
<th>05/06</th>
<th>06/07</th>
<th>07/08</th>
<th>08/09(*)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clausellina/Satsuma/Monreal</td>
<td>406</td>
<td>373</td>
<td>408</td>
<td>365</td>
<td>303</td>
<td>248</td>
<td>355</td>
<td>281</td>
<td>299</td>
<td>300</td>
<td>285</td>
<td>265</td>
<td>257</td>
<td>254</td>
<td>168</td>
<td>280</td>
<td>158</td>
<td>213</td>
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<tr>
<td>Clementina/Clemenvilla o Nova/Hernandina</td>
<td>871</td>
<td>1.027</td>
<td>1.047</td>
<td>1.255</td>
<td>1.139</td>
<td>985</td>
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<td>1.081</td>
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<td>1.607</td>
<td>1.675</td>
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<td>Tangerina/Kara/Fortuna</td>
<td>66</td>
<td>121</td>
<td>134</td>
<td>171</td>
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<td>435</td>
<td>309</td>
<td>361</td>
<td>313</td>
<td>341</td>
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<tr>
<td>Total Petits Fruits</td>
<td>1.342</td>
<td>1.521</td>
<td>1.589</td>
<td>1.791</td>
<td>1.683</td>
<td>1.507</td>
<td>2.099</td>
<td>1.754</td>
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<td>2.009</td>
<td>2.075</td>
<td>2.500</td>
<td>1.945</td>
<td>2.501</td>
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<td>2.229</td>
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<td>Sanguinas/Sanguinelli</td>
<td>15</td>
<td>13</td>
<td>10</td>
<td>8</td>
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<td>8</td>
<td>14</td>
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<td>3</td>
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<td>5</td>
</tr>
<tr>
<td>Total Citrons</td>
<td>589</td>
<td>737</td>
<td>570</td>
<td>563</td>
<td>433</td>
<td>666</td>
<td>968</td>
<td>827</td>
<td>893</td>
<td>938</td>
<td>1.018</td>
<td>962</td>
<td>1.071</td>
<td>810</td>
<td>951</td>
<td>879</td>
<td>550</td>
<td>704</td>
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<tr>
<td>Total Grapefruits</td>
<td>25</td>
<td>30</td>
<td>26</td>
<td>28</td>
<td>29</td>
<td>20</td>
<td>32</td>
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<td>36</td>
<td>33</td>
<td>39</td>
<td>43</td>
<td>45</td>
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</tbody>
</table>

08/09 (*) Forecast

*Effects of frost January-March 05*
SPAIN: CITRUS EXPORTS EVOLUTION (MT)

(*) Saison 2006/07, Record d'Exportation

(*) Saison 2008/09, Prevision

PERMISSION REQUIRED FOR USE
Citrus Tristeza Virus in the world

Distribution Maps of Quarantine Pests for Europe
Cartes de Répartition Géographique des Organismes de Quarantaine pour l'Europe

Citrus tristeza closterovirus

Source: OEPP / EPPO
CTV: A disaster of 100 million trees

Source: IVIA - Pedro Moreno, estimated
Regulations of Authorized Citrus Nurseries in Spain

LEGAL FRAMEWORK

1971 Law 11/71
Seeds and Plants

1972 Decr. 3767/72
General Regulation

1973 O.M. 260773
General Regulation

1976 O.M. 210776
General Regulation

1994 O.M. 281094
Ornamentals Regul.

R.D. 929/95
Technical Regulation
of Fruits Trees
Spanish Certification Scheme. Accredited Nurseries

- Legislative development
- Transitory period
- Existing material at the time
- Introduction of materials from other certification schemes
- Use of varieties with a nucellar origin
- New techniques for obtaining free diseases materials
- Germplasm Bank
- Creation of Foundation ("Base") Nurseries
Main objectives of the Spanish citrus improvement program in Spain 1970

- The obtention of pathogen free propagating material of the Spanish citrus cultivars by shoot-tip grafting *in vitro* (STG)

- To maintain mother trees pathogen free in a germplasm bank

- To release healthy materials to the growers
Certification program

Citrus improvement program

Quarantine program

Import from reliable sources: Spain (IVIA/AVASA), California (UCR-CCPP, USDA), others ??

Alternative
Production in the Spanish certification scheme

• Production of parental material - Agrotechnological Center of reference (IVIA-Instituto Valenciano de Investigaciones Agrarias)

Introduction (Quarantine Station) and maintain of citrus vegetal material with the maximum sanitary and variety guarantee.

• Production of foundation material - Foundation nursery (AVASA-Agrupación de Viveristas de Agriofs, S.A.)

Maintenance and multiplication of citrus vegetal material of foundation category with the maximum sanitary and variety guarantee.

• Production of certified material - Authorized nurseries

Multiplication and final distribution of citrus vegetal material of certified category with sanitary and variety guarantee.
Certification scheme

- Sanitation
- Certification
- Varietal improvement

Certified nursery trees
Certified materials
30 citrus nurseries
Foundation materials (Base)
AVASA & Others
Parental materials
IVIA

Certification scheme diagram.
Rules for citrus certification

Production of initial block material

- Analysis disease detection
  - Positive analysis
    - Micrografting & Cultivation In Vitro
    - Known disease free vegetal material
    - Graft of initial block material
  - Negative analysis
- Initial plant of clone
- Minimum of 3 heading plants.
  - Cultivation in field
  - Initial plant for reservation

- New variety
  - Quarantine Station
- Imported variety
  - Hybridizations
- Spontaneous mutation
  - Others

Production FOUNDATION Material

2 plants protected from vectors

PERMISSION REQUIRED FOR USE
Production of FOUNDATION (base) materials

The HEADING plants are considered FOUNDATION if they maintain their sanitary state after their development and the study of their production during more than 2 crops.

Previous multiplication phase
Foundation multiplication fields
Optional phase, under previous authorization of the Responsible Official Institution

Buds coming from Foundation Plants or Foundation multiplication fields

Production Certified materials

AVASA®
IVIA JAP
CIT 12/97
Ref: 12144
ID: 198886
FI: 05/08/97

PERMISSION REQUIRED FOR USE
A very isolated production

- Strategic location of the production:
  - Remote from citrus orchards
  - With natural isolation
  - No citrus tradition
  - Excellent weather conditions, and suitable for citrus growing
  - Restrictive regulations that do not allow citrus plantations inside the influence area.

1978 AVASA Initial activity
1.980: Certificate of the first budwood diseases free delivered from AVASA to its 9 associated nurseries
First certified multiplication fields in the Foundation Nursery AVASA, in Alcalá de Xivert (Castellón) Spain

• 1980: The first increase blocks were grafted in the current headquarters of AVASA (12 varieties)

  Navelina Sw O  Newhall  Navelate Sw.O. Clemenules Cl
  Oroval Cl  Verna L  Fino L  Fina Cl
  Bruno Cl  Arrufatina Cl  Guillermina Cl  Valles Satsuma

• 10,751 rootstocks are grafted with healthy material of local varieties that have been obtained in the IVIA (Valencia) by first time through the technique of “shoot grafting in vitro”
AVASA Evolution

Foundation Block

Increase Block

Since 1996:
100% under screenhouses
24,500 m²

AVASA today
Current certification for the delivery of parental material
FOUNDATION (base) materials in Spain: Controls

Sanitary evaluation:
Indexing for detection of citrus diseases

Variety evaluation:
Fruit quality analysis and production and agronomical evaluation

Nomination as foundation (base tree)
Sanitary evaluation:

- Exocortis and others viroids, Cachexia, Ringspot, Psoriasis, concave gum, Cristacortis, Impietratura, Citrus leaf blotch (CLB), Psoriasis, concave gum, Cristacortis, Impietratura,

- Dweet mottle, Mosaic, Leaf blotch, Tristeza, Vein enation, Leaf rugose, Witches’ broom, Tatter leaf, Crinkly leaf- Infectious variegation, Satsuma dwarf,
Foundation (Base) mother trees sampling according the Certification Scheme, biological analysis and results communications
Data base of foundation trees, and biological analysis to be practiced.
Biological analysis of foundation trees

Estructura - Informe Analisis AB

José Folch Beltran
viernes, 08 de mayo de 2009

Muestras tomadas para Análisis entre 05/11/1998 y 4/05/2009

1.1 Clementinos

<table>
<thead>
<tr>
<th>Arrufatina(P)</th>
<th>58</th>
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<tbody>
<tr>
<td>Ref mueva y ant. injerto</td>
<td>Análisis</td>
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<td>0900</td>
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<td>5,1</td>
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<td>0403</td>
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<td>5,1</td>
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<td>0001</td>
<td>5,1</td>
</tr>
<tr>
<td>9801</td>
<td>5,1</td>
</tr>
</tbody>
</table>

Analysis 2009:  
- Forecast 880  
- Realized 301  
- Pending 579
Deliveries of samples for ELISA - CTV
### Results of ELISA – CTV analysis

**DATOS DEL INTERESADO**

- **Nombre:** Sección de Sanidad y Certificación Vegetal (A.V.A.S.A)
- **Dirección:** Plaza Alcalde Domingo Torres nº 1
- **Tel.:** 963931830 **Fax:** 963931468
- **Localidad:** Valencia
- **Provincia:** Valencia
- **Código Postal:** 46020

**DATOS DEL ANÁLISIS**

- **Cultivo:** Citricos
- **Fecha recepción:** 15/01/09
- **Término municipal:** Alcalá de Chivert
- **Número de muestras:** 42 (Lavas 0813)
- **Identificación de las muestras:** CV-123/001:08-9-M

**DIAGNÓSTICO DEL LABORATORIO**

- **CTV**
- **Muestras positivas:** ninguna
CTV analysis made by E.L.I.S.A.

<table>
<thead>
<tr>
<th>Year</th>
<th>Foundat. trees</th>
<th>Results</th>
<th>Increase blocks</th>
<th>Results</th>
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<tbody>
<tr>
<td>2009</td>
<td>2.228</td>
<td>-2.228</td>
<td>14.032</td>
<td>-14.032</td>
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<tr>
<td>2008</td>
<td>1.625</td>
<td>-1.625</td>
<td>10.733</td>
<td>-10.733</td>
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<tr>
<td>2007</td>
<td>1.693</td>
<td>-1.693</td>
<td>16.073</td>
<td>-16.073</td>
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<tr>
<td>2006</td>
<td>1.882</td>
<td>-1.882</td>
<td>18.839</td>
<td>-18.839</td>
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<tr>
<td>TOTAL</td>
<td>7.428</td>
<td>-7.428</td>
<td>59.677</td>
<td>-59.677</td>
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</table>
# Evaluation of variety quality

- Fruit quality analysis

## Data base of citrus varieties

<table>
<thead>
<tr>
<th>Análisis</th>
<th>Grupo</th>
<th>Muestra</th>
<th>Clon</th>
<th>Patrón</th>
<th>Localidad</th>
<th>Referencia</th>
<th>F. Recolección</th>
<th>F. Análisis</th>
<th>Realización</th>
<th>Campaña</th>
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<tr>
<td></td>
<td></td>
<td>LANE LATE</td>
<td>199</td>
<td>CC</td>
<td>AV</td>
<td>71122</td>
<td>13/05/2005</td>
<td>20/05/2005</td>
<td>20/05/2005</td>
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## Table of Analysis

<table>
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<tr>
<th>Data</th>
<th>Value</th>
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<tr>
<td>Nº Frutos</td>
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<td>Peso Fruto</td>
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<tr>
<td>Peso Muestra</td>
<td>1,547</td>
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<tr>
<td>Volumen Fruto</td>
<td>80,5</td>
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<tr>
<td>Peso Descachos</td>
<td>1,164</td>
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<tr>
<td>Vol. llorado</td>
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<td>Densidad Zumo</td>
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<td>Cítrico</td>
<td>10,42</td>
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<tr>
<td>T</td>
<td>19,2</td>
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<tr>
<td>Sol. disuellos</td>
<td>9,9</td>
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<td>Vol. Na Cl</td>
<td>4,9</td>
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<tr>
<td>Factor</td>
<td>1,20</td>
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</tbody>
</table>

## Observaciones
Total traceability in the distribution of the material

### Origin of the material
- Hernandina (P)
- IVIA 12

### Distribution
- 21/02/2009
- Codex: B09827

### Sanitary state
- Análisis Biológicos
  - Estado: Validado, No Validado

---

**Note:** debe trabajarse solo con filtros "Clave" y "Ref Cede"
Production of CERTIFIED material

Buds coming from Foundation Mother Trees

Buds coming from Foundation Multiplication Fields

CERTIFIED PLANT

AUTHORIZED CITRUS NURSERIES

PERMISSION REQUIRED FOR USE

CERTIFIED multiplication fields

Fields of CERTIFIED plants
Historical evolution of certified citrus trees

1972-2008  37 years
152,918,532 plants
313,000 Has
90% of the total surface

Source: AVASA, with information facilitated by the Spanish Ministry of Agriculture and the different Autonomous Governments
Upd.: 20/May/2009
Plants vs MT of citrus in Spain

Source: AVASA, with information facilitated by the Spanish Ministry of Agriculture and the different Autonomous Governments  
Upd.: 20/May/2009
Certified citrus trees sold in Spain
Top-Ten 2004-2008

Top-Ten: 19,086,086 trees (72 %)
Total: 26,365,623 trees (100 %)

Source: AVASA, with information facilitated by the Spanish Ministry of Agriculture and the different Autonomous Governments

Updated: 04/June/2009
Number of certified citrus varieties sold in Spain

<table>
<thead>
<tr>
<th>Group / Year</th>
<th>1972</th>
<th>2008</th>
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<tbody>
<tr>
<td>Mandarins</td>
<td>6</td>
<td>34</td>
</tr>
<tr>
<td>Sweet oranges</td>
<td>6</td>
<td>24</td>
</tr>
<tr>
<td>Lemons</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>Grapefruits</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>19</strong></td>
<td><strong>67</strong></td>
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2.008: Rootstocks in Spain

Source: AVASA, with information facilitated by the Spanish Ministry of Agriculture and the different Autonomous Governments

Upd.: 20/May/2009
Rootstocks in Murcia Region 2.008

Source: AVASA, with information facilitated by the Spanish Ministry of Agriculture and the different Autonomous Governments

Upd.: 20/May/2009
Obligatory statement for propagating materials

- Mother tree for seed production
- Seedbeds
- Rootstock nursery
- Increasing blocks of certified buds
- Certified nurseries trees
- Basic (foundation) mother trees
- Remaining plants of the last season
- Season summary
- Stock of identity labels
- Cultivation blocks
Structural organization of the Citrus Nurseries

Foundation (base) nurseries

Spanish example of the first Foundation (base) Nursery – AVASA®

· Associated nurseries
  Alcanar, S.A.T.  Centrals, S.A.T.
  Sevilla, S.A.   Beniplant, S.L.
  Gurbí, S.A.T    Citroplant, S.L.
  Valencia, S.A.T Vivercitrus 2.000, S.L.
  Gregal, S.L.    Vivemur, S.L.
  Pascual Hnos,S.A.

· Location
· Installation
AVASA: current facilities

- 24,500 m² screenhouses
  - Foundation mother tree: up to 990 (D40 container) in 2,700 m² & up to 400 ground plants in 12,000 m²
  - Multiplication blocks, ground: up to 30,000 in 9,800 m²
Protected Foundation block in AVASA
Average production

• Foundation mother tree in container 50–500 buds/year
  - Between 50,000 & 500,000 buds/year

• Foundation mother tree in ground 1000–4000 buds/year
  - Between 350,000 & 1,200,000 buds/year
Protected increase blocks in AVASA average production

• Duration: 3 years up to 5 years, and they can produce each year:
  – 1st year: 15 buds/plant  - 2nd year: 40 buds/plant
  – 3rd year: 60 buds/plant  - 4th year: 90 buds/plant
  – 5th year: 120 buds/plant

• 2000 m²/year (6000 plants) must be renew to maintain the cycle
AVASA protected increased blocks average annual production

<table>
<thead>
<tr>
<th>Age (years)</th>
<th>Trees</th>
<th>Production buds/year</th>
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<tbody>
<tr>
<td>1</td>
<td>6000</td>
<td>90.000</td>
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<tr>
<td>2</td>
<td>6000</td>
<td>240.000</td>
</tr>
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<td>3</td>
<td>6000</td>
<td>360.000</td>
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<td>4</td>
<td>6000</td>
<td>540.000</td>
</tr>
<tr>
<td>5</td>
<td>6000</td>
<td>720.000</td>
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<td><strong>TOTAL</strong></td>
<td>30.000</td>
<td><strong>1.950.000</strong></td>
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<td>Year</td>
<td>Certified Budwood</td>
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<td>2,635,409</td>
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</tr>
<tr>
<td>2006</td>
<td>2,380,145</td>
<td></td>
</tr>
<tr>
<td>2007</td>
<td>2,470,226</td>
<td></td>
</tr>
<tr>
<td>2008</td>
<td>1,865,081</td>
<td></td>
</tr>
<tr>
<td>2009</td>
<td>1,741,656</td>
<td></td>
</tr>
</tbody>
</table>

**Total estimated production of certified budwood in AVASA**
AVASA: Budwood obtained during the last 5 years

<table>
<thead>
<tr>
<th>Material</th>
<th>2005</th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
</tr>
</thead>
<tbody>
<tr>
<td>Base (F.)</td>
<td>131.307</td>
<td>100.995</td>
<td>27.500</td>
<td>96.665</td>
<td>114.665</td>
</tr>
<tr>
<td>Certified</td>
<td>1.854.000</td>
<td>2.096.000</td>
<td>1.405.000</td>
<td>1.187.000</td>
<td>1.150.000</td>
</tr>
</tbody>
</table>

These figures correspond with the distributed material (50 – 75 % of the total production)
AVASA: Cutted budwood 1990-2009 (20 Y.)

<table>
<thead>
<tr>
<th>Year</th>
<th>Base (F)</th>
<th>Certified</th>
<th>Total</th>
<th>Year</th>
<th>Base (F)</th>
<th>Certified</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1990</td>
<td>57.230</td>
<td>511.000</td>
<td>568.230</td>
<td>2001</td>
<td>72.400</td>
<td>839.900</td>
<td>912.300</td>
</tr>
<tr>
<td>1991</td>
<td>492.400</td>
<td>487.200</td>
<td>979.600</td>
<td>2002</td>
<td>145.885</td>
<td>944.000</td>
<td>1.089.885</td>
</tr>
<tr>
<td>1992</td>
<td>176.000</td>
<td>519.300</td>
<td>695.300</td>
<td>2003</td>
<td>73.385</td>
<td>1.465.970</td>
<td>1.539.355</td>
</tr>
<tr>
<td>1993</td>
<td>154.165</td>
<td>881.400</td>
<td>1.035.565</td>
<td>2004</td>
<td>115.510</td>
<td>1.693.840</td>
<td>1.809.350</td>
</tr>
<tr>
<td>1995</td>
<td>440.100</td>
<td>1.043.800</td>
<td>1.483.900</td>
<td>2006</td>
<td>100.995</td>
<td>2.096.000</td>
<td>2.196.995</td>
</tr>
<tr>
<td>1996</td>
<td>170.205</td>
<td>1.341.000</td>
<td>1.511.205</td>
<td>2007</td>
<td>27.500</td>
<td>1.405.000</td>
<td>1.432.500</td>
</tr>
<tr>
<td>1999</td>
<td>243.100</td>
<td>1.181.200</td>
<td>1.424.300</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2000</td>
<td>91.200</td>
<td>1.289.550</td>
<td>1.380.750</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Total Certified Base (F) Year Total Certified Base (F) Year**

| 1990-09 | 3.357.767 | 23.982.610 | 27.340.377 |
Cultivation under screenhouses

- Lower water allocation needed due to a lower evotranspiration
- Faster growth
- Exuberant vegetation, trees of bigger size
- Faster evolution of citrus pests (shorter cycles) and more difficulties to control them (mites in particular).
- Higher technical and control requirements to manage trees in container during large periods
- **Light** improvement of the internal maturity ratio and delay of the rind coloring (with lower intensity)
- Larger rind thickness in the fruit
- Fruits with lower hardness and storage capacity, with *lightly* shorter commercialization period
- In spite of these **light differences**, the fruit maintains the standard characteristics of the variety, and let its clear differentiation and pertinent analysis. The comparative evaluation is let, as all varieties are under the same conditions
AVASA facilities

- 24,500 m² multichapel screenhouses of 3.5 to 4 m under gutter
- 45,000 m² of anti-trip mesh with 16x10 threads/cm².
- 17 enclosures with a double door to accede
- Blocks are separated by anti-trip mesh

**TOTAL: 650,000 € + VAT**
Structural organization of the Citrus Nurseries

Advantages of the Association compared to the Individual Nurseries.

- Scale economy
- Location selection
- Dimension of the nursery
- Management and development of institutional helps
- Agreements with IVIA to the maintenance of the parent material
- Analysis and evaluation of Foundation Trees
- Productive capacity and real need of buds:
  - Clemenules or clemencruby pattern
- Introduction of the new varieties “AVASA PRI”
  - Management of license agreements
- Obtention of new varieties
Current situation

Creation of new companies and dispersion of the production. Evolution of:

- Number of Authorized Nurseries
- Commercialization of citrus plants
- Number of Foundation (base) Nurseries
- New production zones and official control organizations
Current situation

Evolution in the number of Authorized Nurseries
Evolution in the commercialization of citrus plants

Source: AVASA, with information of the Spanish Ministry of Agriculture and the Autonomous Governments
Updated: 10/june/2009
Current situation

Evolution of Foundation Nurseries and nursery trees

Source: AVASA, with information of the Spanish Ministry of Agriculture and the Autonomous Governments. Updated: 08/june/2009
New work lines in AVASA

- Obtaining of news varieties
  - Selection of spontaneous mutations
  - Agreements with the IVIA for obtaining triploid hybrids
  - Agreements for obtaining irradiated varieties
- International management of license agreements for citrus patented varieties
20 New improved clementine selections
1902 – 2006
Selection and evaluation of improved natural mutations
Breading of new varieties. Agreements AVASA / IVIA for obtaining late Triploid Mandarins

+ 10.500 Triploids obtained in Spain, 190 parental combinations

Preliminary result about a total of 1.615 evaluated triploid hybrids 1.107 (2n x 2n) and 508 (2n x 4n)

<table>
<thead>
<tr>
<th>Quality</th>
<th>Rippening period</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Middle</td>
</tr>
<tr>
<td>Intermediate</td>
<td>24</td>
</tr>
<tr>
<td>Good</td>
<td>7</td>
</tr>
<tr>
<td>Very good</td>
<td>4</td>
</tr>
<tr>
<td>TOTAL</td>
<td>35</td>
</tr>
</tbody>
</table>

Source: AVASA (own information) and IVIA
Updated: 04/07/2008
Hybrids IVIA - AVASA
2n x 2n : + 4.000

Female parent
Fortune
Clemenules
Hernandina
Marisol
Fina
Monreal

Male parent
Fortune
Nova
Murcott
M. Común
Ellendale
Kara
Ortanique
Freemont
N. Comuna
Clemenules
Loretina
Tang. Orlando y Mineola
Hybrids IVIA - AVASA

2n x 4n : 3500
4n x 2n : 3000

Female parent
Clemenules
Hernandina
Fina
Marisol
Fortune

Male parent
Tangelo Orlando
Naranjo Pineapple
Nova
Evolution in the commercialization of Mandarin versus protected/patented varieties. 2002 – 2008

Source: AVASA with information of the Spanish Ministry of Agriculture
Summary and conclusions

Problematic of the Spanish citrus nurseries before having available known diseases free varieties.

Consequences of the use of diseases free varieties by the Spanish nurserymen

Impact of the Sanitary and Certification Programs in the Spanish citrus industry.
Problematic of the Spanish citrus nurseries before having available known diseases free varieties

• Production of plants with a low-quality

• High production costs. Infected varieties with a poor vigor.

• Rejection of the grower to pull up the plantations and to acquire new plants.

• Existence of small clandestine nurseries.
Consequences of the use of diseases free varieties by the Spanish nurserymen

• Association of nurserymen to the establishment and maintenance of pathogen free initial material.
• Production of certified plants with a high quality.
• Reduction of the production costs.
• High demand of certified plants by the grower.
• Important reduction of clandestine nurseries and an increase of authorized nurseries.
• Increase of the total sales
• Become more technical all the propagative processes.
• Possibility of export disease free propagation material (foundation and certified).
Impact of the Sanitary and Certification Programs in the Spanish citrus industry

• Production and quality of fruit are increased between 15 to 20 % in new plantations

• Restrictions in the use of rootstocks, concerning the sanitary state, have been eliminated

• Increase in the number of high quality varieties, available for propagation.

• Adjustment between the production structure and the international market demand.

• Since 1.972, the beginning of the Spanish certification, more than 100 million of citrus plants have been established in Spain.

• These new plantations will increase their benefits, approximately 200 million € / year, when they reach full production.