Brazil Apple Orchards

Poliana Francescatto
Apple Producing Countries
World Apple Production

2013 - 80,82 million ton

- Brazil

- 1. China (37 milhões toneladas)
- 2. Estados Unidos (4,1)
- 3. Turquia (2,9)
- 4. Polônia (2,9)
- 5. India (2,2)
- 6. Itália (2,0)
- 7. Irã (1,7)
- 8. Chile (1,6)
- 9. Rússia (1,4)
- 10. França (1,4)
- 11. Brasil (1,3)
- 12. Argentina (1,2)
- 13. Ucrânia (1,1)
- 14. Alemanha (1,0)
- 15. Uzbequistão (0,8)
- 16. África do Sul (0,8)
- 17. Japão (0,8)
Brazil

66 million bushels
90,000 acres
744bu/acre

Latitude – 26º - 28º S
Altitude – 650 – 1400 m
Apple Production in Brazil

66 million bushels

Varieties produced in Brazil

- **Gala**: (Imperial Gala; Maxi Gala ...): ........................................... 59%
- **Fuji**: (Fuji; Fuji Suprema; Fuji Select ...): ........................................... 34%
- **Others**: (Eva; Castel Gala, Condessa, Pink Lady, Daiane): .... 7%

93%

Fresh Apple in Brazil

Brazilian consumers know basically three types of apple

‘Gala’, ‘Fuji’ and “Argentina”
### Apple picking season in Brazil

<table>
<thead>
<tr>
<th>Cultivar</th>
<th>Dez</th>
<th>Jan</th>
<th>Fev</th>
<th>Mar</th>
<th>Abr</th>
<th>Mai</th>
<th>Jun</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gala/clones col.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>?</td>
</tr>
<tr>
<td>Fuji/clones col.</td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

The table shows the apple picking season in Brazil, with the highlighted months indicating the suitable time for picking. 

The table indicates that Gala/clones col. is suitable to pick from Fev to Abr, while Fuji/clones col. has an unspecified season, highlighted with a question mark. This suggests further investigation is needed for the optimal picking period for Fuji varieties.
Evolution of Apple Crop in Brazil

Thousand tons

- Import
- Export
- Production

Year
- 1961
- 1963
- 1965
- 1967
- 1969
- 1971
- 1973
- 1975
- 1977
- 1979
- 1981
- 1983
- 1985
- 1987
- 1989
- 1991
- 1993
- 1995
- 1997
- 1999
- 2001
- 2003
- 2005
- 2007
- 2009
## Brazilian Apple growers

<table>
<thead>
<tr>
<th>State</th>
<th>Growers</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Santa Catarina</td>
<td>1,622</td>
<td>67%</td>
</tr>
<tr>
<td>Rio G. do Sul</td>
<td>698</td>
<td>29%</td>
</tr>
<tr>
<td>Paraná</td>
<td>100</td>
<td>4%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>2,420</strong></td>
<td><strong>100%</strong></td>
</tr>
</tbody>
</table>

### Main companies:

- **Schio Agropecuaria**: 8,250 acres
- **Fischer S/A**: 6,250 acres
- **Rasip**: 2,750 acres
- **Sanjo**: 2,750 acres
Climate Conditions

Average annual precipitation:

Geneva – 33 inches
Fraiburgo – 71 inches
Chilling hours accumulation <45°F

Apple producing cities in Brazil

São Joaquim | Vacaria | Fraiburgo | Cacador | Palmas

- Sao Joaquim
- Vacaria
- Fraiburgo
- Cacador
- Palmas

Chilling Hours (<45°F)

2015

2013
Consumers prefer medium-sized apples. Fruit size produced in Brazil is around 130-150g in average.
Adapting to low chilling conditions

Brazilian growers had to adapt new growing methods to be able to grow apples under threshold conditions (mild winters, wet spring/summer)

Costs
Limiting factors and Challenges to grow apples in Brazil

• Lack of adapted cultivars (recent releases);
• Low chilling accumulation – "weak buds", poor bud break, irregular flowering;
• Fruit size and quality;
• Color (warm nights);
• Long season – vigor;
• Harvest management (large blocks – 2 varieties - concentrated harvest);
• Lack of labor associated to low quality work;
• Consumers preference.
Consequences of low chilling accumulation

Fuji Suprema

Grown in Sao Joaquim

Grown in Fraiburgo

São Joaquim 1,350 m altitude; ± 950 Chill hours

Fraiburgo 980 m altitude; ± 600 Chill hours
So...

How do we survive??
Dormancy induction

- As an adaptive process, temperate crops (fruit, grape) go through a dormant period.
- In sub-temperate climates, trees are not prepared for and thus present active metabolism during winter (leaves on shoot tips).

- Defoliation:
  - Urea
  - Cooper
  - ABA !!!
Daily maximum and minimum temperatures during winter

Caçador, SC – Brazil

2011

Geneva, NY – US
Dormancy Breaking Compounds

Silver tip stage:
- **Hydrogen Cyanamide** (Dormex)
- Inorganic Nitrogen (Erger)
- Glutamic Acid (Syncron)
- Mineral oil
- Lime sulfur
Mechanisms of adaptation to “poor” winter conditions
Mechanisms Of Adaptation To Poor Fruit Set Conditions

- TDZ – Cytokinin 10-15 ppm – Baloon stage (E₂ – F);
- AVG – Retain (1/2 pouch to 2 pouch)
- Prohexadione calcium – Apogee – 2-14 oz (Full bloom);
- Trunk Girdling
Thinning Strategies for Gala

- **PROMALIN 0,5 L/Ha**
- **ANA 7.5 – 10 PPM**
- **MAXCEL 2 L/Ha**
- **ETREL 100-150 PPM**
- **ETREL 100-150 PPM + MAXCEL 2 L/Ha**
- **Hand thinning**

<table>
<thead>
<tr>
<th>E2-F</th>
<th>F2</th>
<th>G-H</th>
<th>5</th>
<th>10</th>
<th>15</th>
<th>20</th>
<th>25</th>
<th>30</th>
<th>35</th>
<th>40</th>
</tr>
</thead>
</table>

Fruit diameter

Carbaryl
Thinning Strategies for Fuji

<table>
<thead>
<tr>
<th>E2–F</th>
<th>F2</th>
<th>G–H</th>
<th>5</th>
<th>10</th>
<th>15</th>
<th>20</th>
<th>25</th>
<th>30</th>
<th>35</th>
<th>40</th>
</tr>
</thead>
</table>

- **PROMALIN 0,75 L/Ha**
- **ANA 10–15 PPM**
- **MAXCEL 4 L/Ha**
- **ETREL 100–150 PPM**
- **MAXCEL 4 L/Ha + ETREL 100–150 PPM**
- **Hand thinning**

Fruit diameter

- 80 ppm BA
Warm and rainy summers – regrowth problems
Long growing season Vigor control

Prohexadione Calcium (Viviful)
Trinexapac-ethyl – (Moddus)
Main apple diseases in Brazil

**Spring**
- Sarna
- Apple Scab
- Powdery mildew

**Summer**
- Bitter rot (Glomerella)
- MFG
- Fruit rot
- Marssonina
European canker
\textit{(Nectria galligena)}

Since 2002
Boom – 2012 to nowadays
Number of pesticides application

- Gala e Fuji
- Joaquina e Catarina

<table>
<thead>
<tr>
<th></th>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Gala e Fuji</td>
<td>24</td>
<td>23</td>
</tr>
<tr>
<td>Joaquina e Catarina</td>
<td>15</td>
<td>13</td>
</tr>
</tbody>
</table>
Hilly and Flat areas
Our largest Gala apples are located in the terminal bud of a one year old shoot
Rootstock available in Brazil

Marubakaido

CG.874

MM.106

M.7

CG.213

M26

M9

Marubakaido/M9

vigor
- Similar vigor to M.26;
- High density orchards (>800 trees/acre);
- requires tree support;
- few root suckers and no burrknots;
- High resistance to crown rot and wooly apple aphid; lesser susceptible to white root rot than M.9 e M.26;
- Shows good performance at replanting areas;
- Good branching and bud break, flatter and thinner branches than M.9;
- Very promising for Brazil!!!
G.213
Easier to propagate in stoolbed
A lot of liners

M.9
Hard to propagate

G.213
G.213

Open Canopy

M.9
Vertical branches

G.213
Flatter branches

Branching

3rd leaf - M.9
Few branches = few fruit

3rd leaf - G.213
More branches = + fruit
- Similar vigor to M.7
- Medium density orchards;
- Resistant to crown rot;
- Resistant to woolly apple aphid;
- Few root suckers;
- No burrknotted;
- Great performance in replanting areas;
- Requires tree support.
Stoolbed

Good rooting

G.874
Uniform liners

M.7
Irregular liners

Good things about G.874
No suckers and no burrknots

High precocity and yield

Good things about G.874
However...

It requires tree support
Marubakaido

- Very vigorous rootstock – Rocky and infertile soils
- Strong root system, great adaptation to any type of soil;
- Easy propagation - cuttings;
- Too many root suckers, mainly if M9 is used as interstock;
- Resistant to crown rot and wholly apple aphid;
- No burrknots;
- Low to medium density orchards
- Good in replanting soil
- Good for Spur varieties;
- Sensitive to viruses.
- Not precocious
Marubakaido/M9

- Similar vigor to M-7;
- Both rootstocks balance vigor and soil diseases, M9 induces good yields
- 6-8 inches long of rooted Marubakaido plus 6-8 inches long of M-9 cutting. Scion will be grafted in the following year;
- Depending on soil type and rooting level there is no need of tree support;
- High cost of production;
Maruba/M.9
Suckering; Burrknots
& Woolly apple aphid in the M.9

Maruba/M.9
Suckers

G.874
No Suckers

Interstock

Maruba
Maruba
# TREE SPACING ACCORDING TO ROOTSTOCK/SCION RECOMMENDATION FOR BRAZIL

<table>
<thead>
<tr>
<th>Rootstock</th>
<th>Vigorous cultivar</th>
<th>Standard (semi-vigorous)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Tree spacing</td>
<td>Trees/acre</td>
</tr>
<tr>
<td>Dwarfs</td>
<td>12 x 3</td>
<td>1,210</td>
</tr>
<tr>
<td>M-9, M-26,</td>
<td>12 x 4</td>
<td>908</td>
</tr>
<tr>
<td>CG.4213</td>
<td>13 x 5</td>
<td>670</td>
</tr>
<tr>
<td>Semi-dwarfs</td>
<td>13 x 5</td>
<td>670</td>
</tr>
<tr>
<td>M-7, MM-106</td>
<td>16 x 5</td>
<td>545</td>
</tr>
<tr>
<td>CG.874,</td>
<td>16 x 7</td>
<td>389</td>
</tr>
<tr>
<td>Semi-vigorous</td>
<td>16 x 8</td>
<td>340</td>
</tr>
<tr>
<td>MM-111</td>
<td>20 x 10</td>
<td>218</td>
</tr>
<tr>
<td>Vigorous</td>
<td>18 x 10</td>
<td>242</td>
</tr>
<tr>
<td>Marubakaido</td>
<td>20 x 11</td>
<td>200</td>
</tr>
</tbody>
</table>
PAST AND CURRENT SITUATION OF THE APPLE PLANTING SYSTEMS, TREE DENSITY AND YIELD EFFICIENCY IN BRAZIL

- 200 - 300 trees/acre, 250 - 320 bu/acre
- 300 - 400 trees/acre, 320 - 500 bu/acre
- 400 - 600 trees/acre, 500 - 640 bu/acre
- 600 - 700 trees/acre, 640 - 850 bu/acre
- 700 - 1,400 trees/acre, 850 - 1,300 t/ha
- >1400 trees/acre, 1,300 - 1,700 bu/acre
Thank you!

Muito Obrigado!