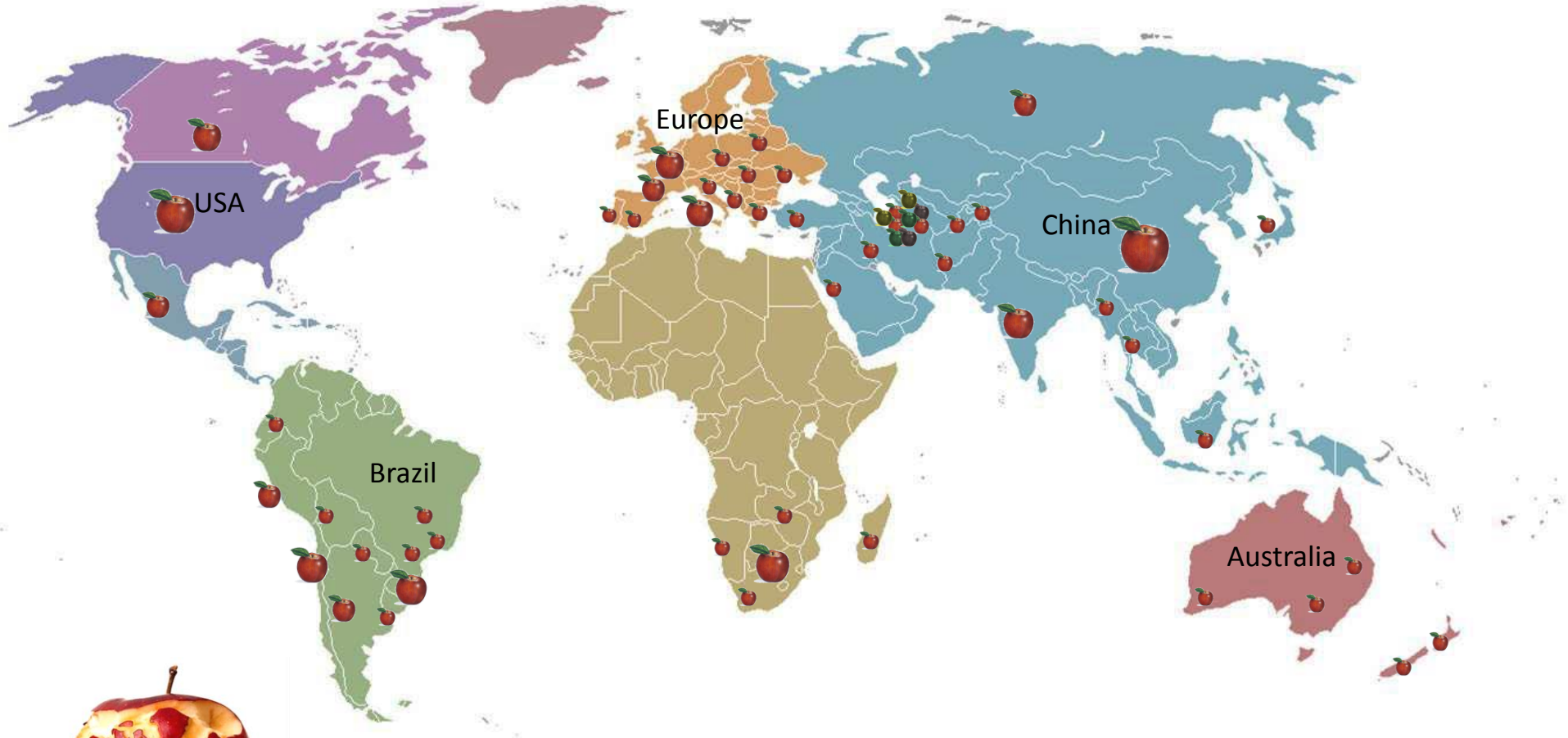


**Dept. of Horticulture, Cornell University  
Geneva, NY**

# **Brazil Apple Orchards**

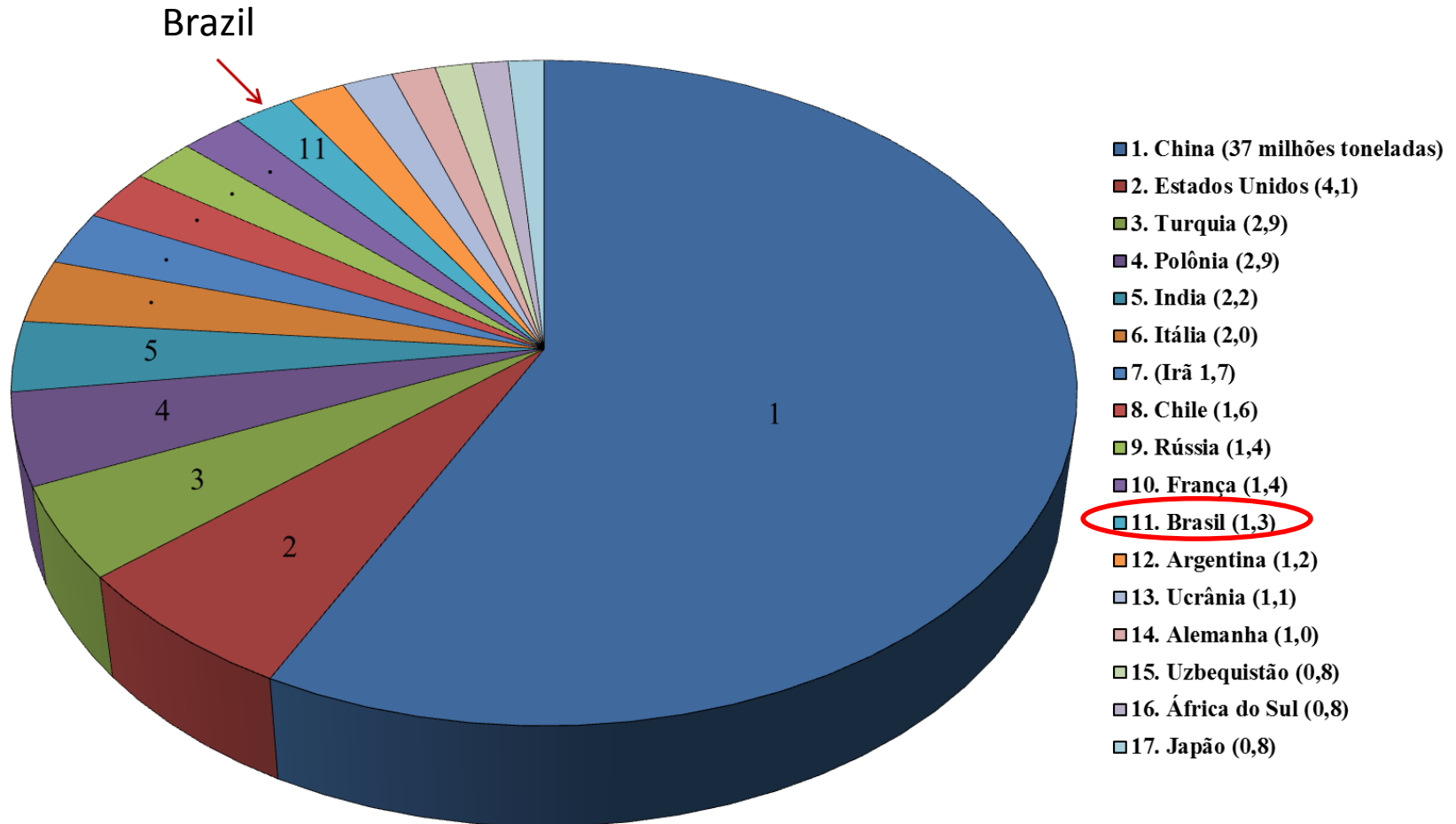
**Poliana Francescato**

# Apple Producing Countries



# World Apple Production

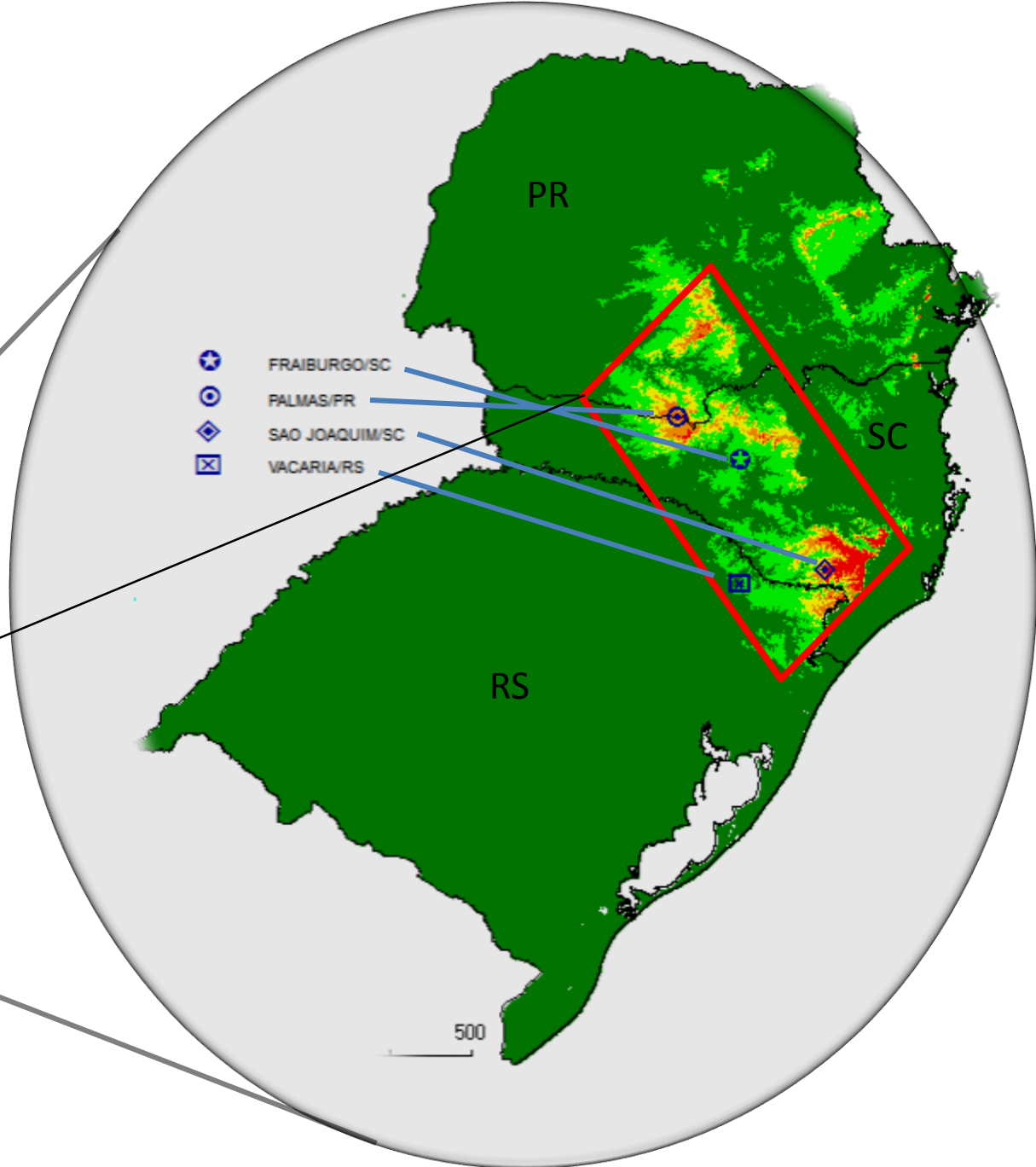
2013 - 80,82 million ton



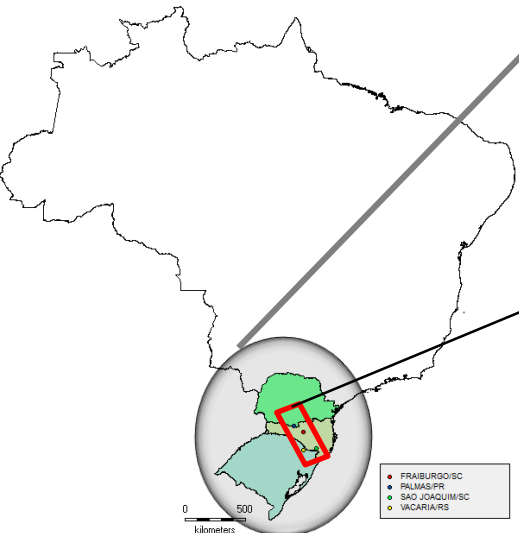


# Brazil

**66 million bushels**  
**90,000 acres**  
**744bu/acre**



- ★ FRAIBURGO/SC
- PALMAS/PR
- ◆ SAO JOAQUIM/SC
- ⊠ VACARIA/RS



**Latitude – 26° - 28° S**  
**Altitude – 650 – 1400 m**



# Apple Production in Brazil

66 million bushels

## Varieties produced in Brazil

↪	<b>Gala:</b> (Imperial Gala; Maxi Gala ...): .....	59%	} 93%
↪	<b>Fuji:</b> (Fuji; <u>Fuji Suprema</u> ; Fuji Select ...): .....	34%	
↪	<b>Others</b> (Eva; Castel Gala, Condessa, Pink Lady, Daiane): ....	7%	

## Fresh Apple in Brazil

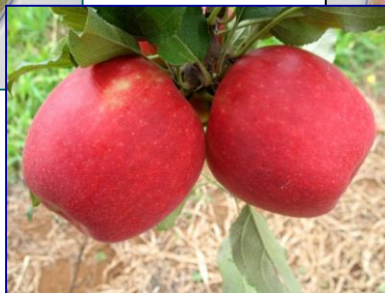
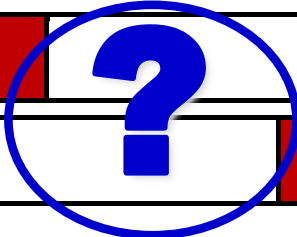
Brazilian consumers know basically three types of apple

‘Gala’, ‘Fuji’ and “*Argentina*”

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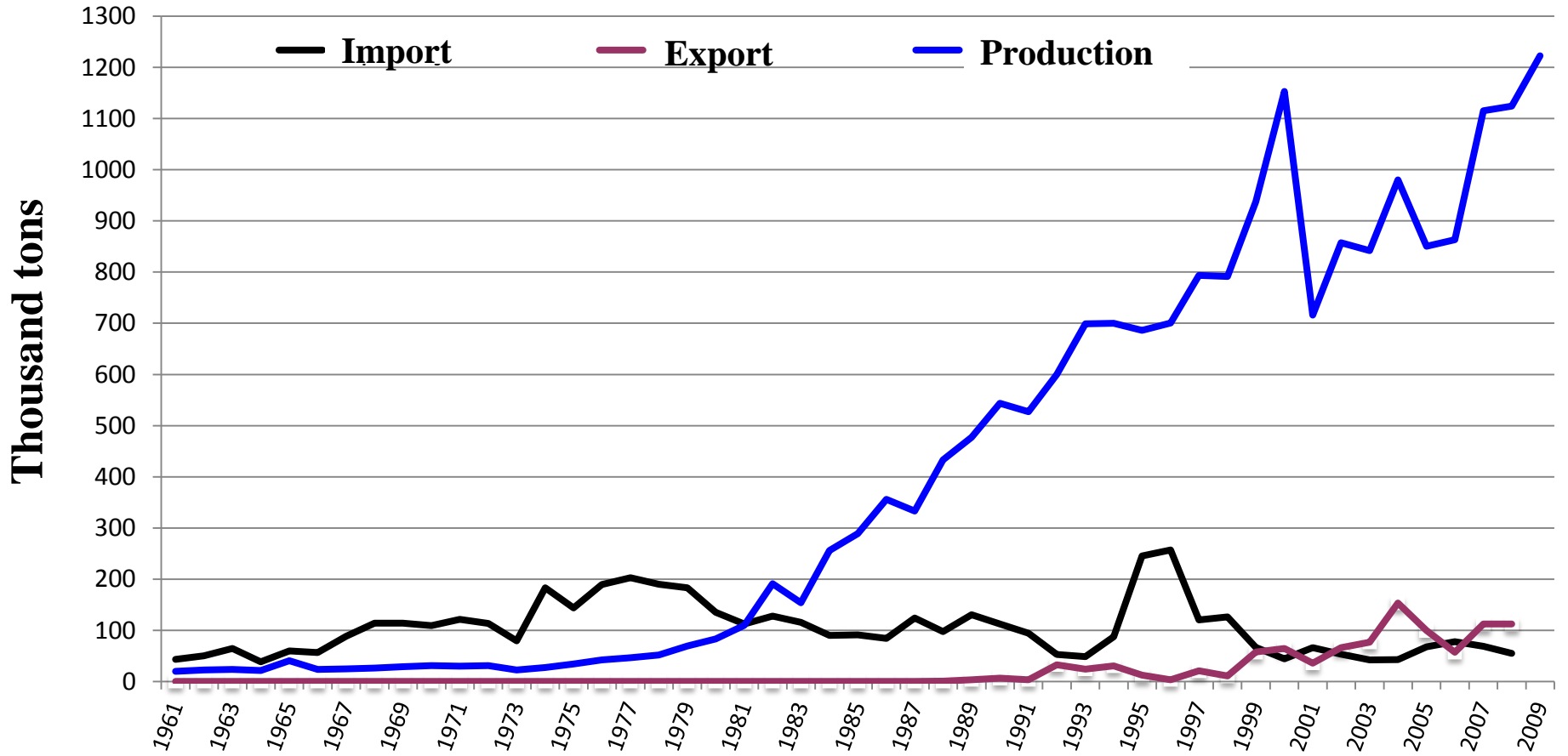
# Apple picking season in Brazil

Cultivar	Dez	Jan	Fev	Mar	Abr	Mai	Jun
Gala/clones col.							
Fuji/clones col.							





# Evolution of Apple Crop in Brazil





## Brazilian Apple growers

<u>State</u>	<u>Growers</u>	
Santa Catarina	1.622	67%
Rio G. do Sul	698	29%
<u>Paraná</u>	<u>100</u>	<u>4%</u>
Total	2.420	100%

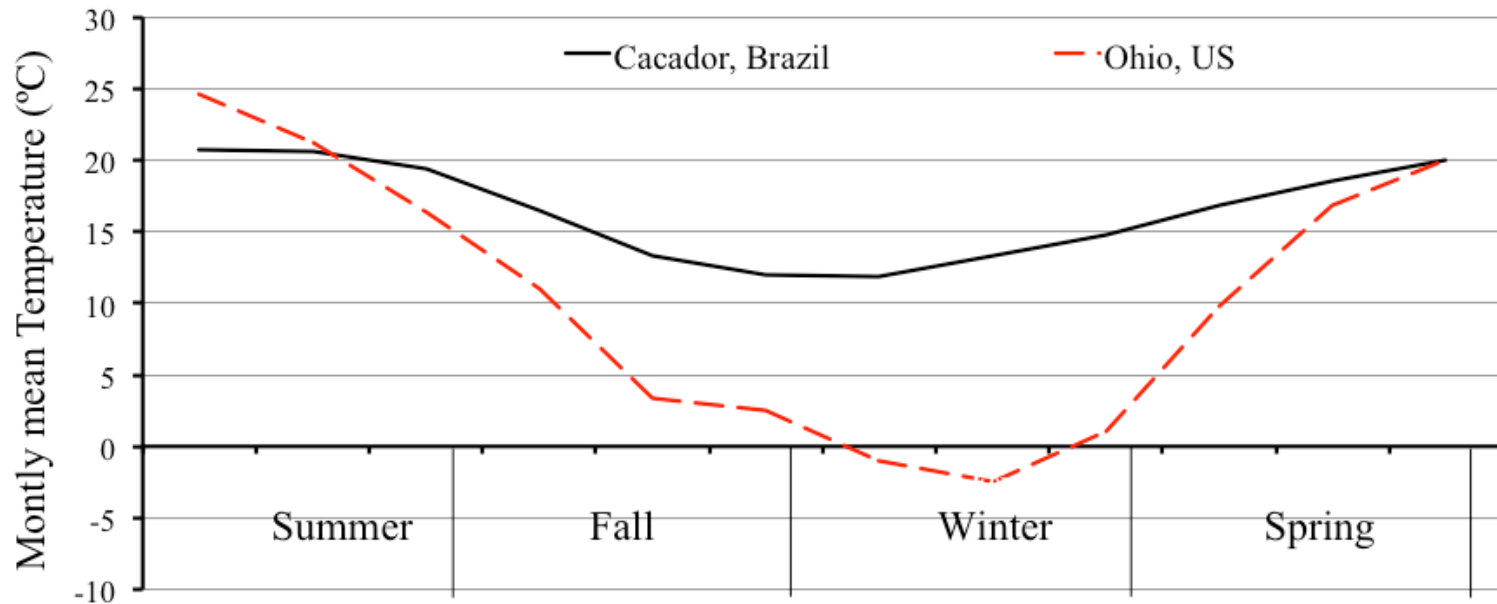
### Main companies:

Schio Agropecuaria	8,250 acres
Fischer S/A	6,250 acres
Rasip	2,750 acres
Sanjo	2,750 acres





# Climate Conditions



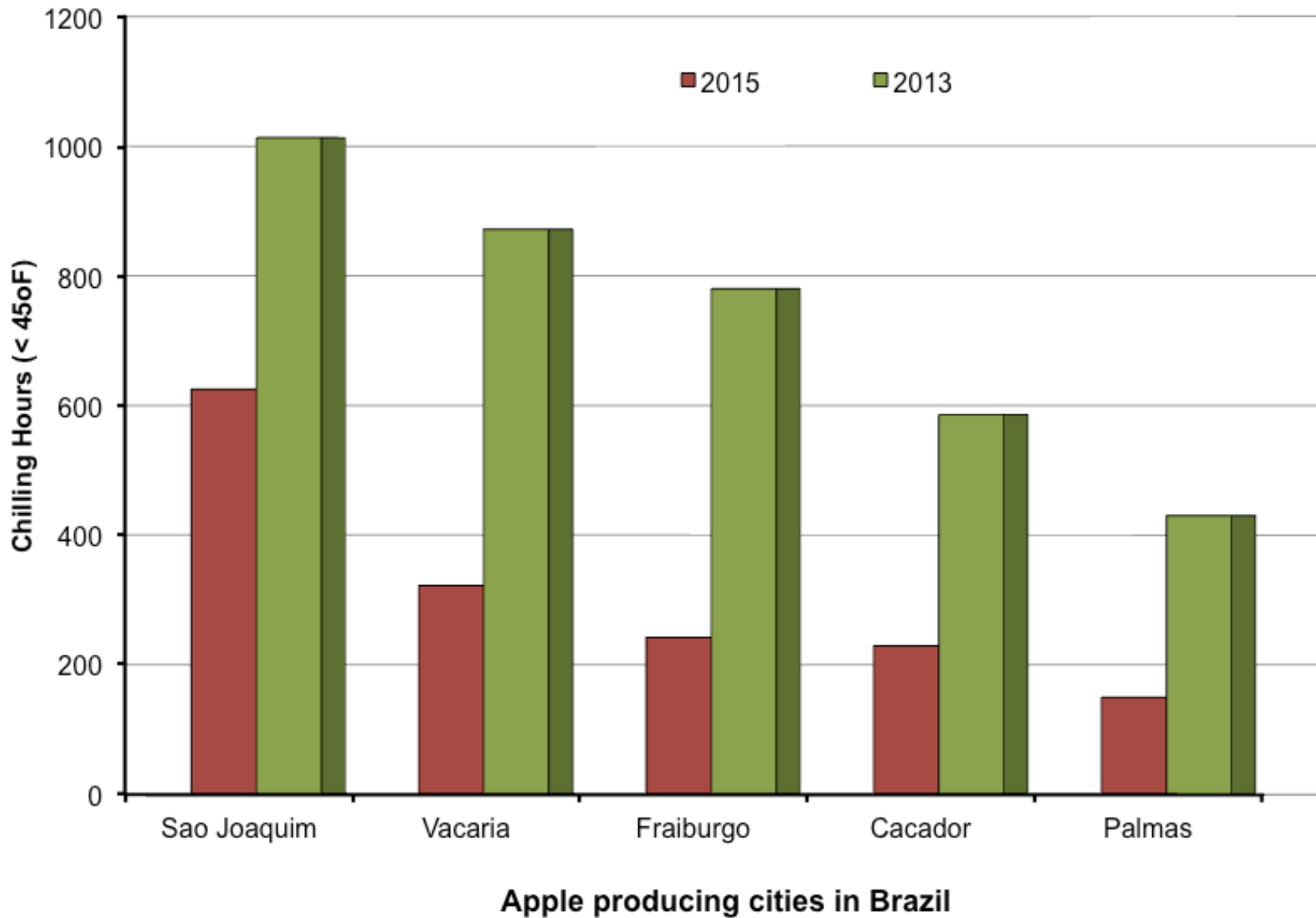
## Average annual precipitation:

Geneva – 33 inches

Fraiburgo – 71 inches



# Chilling hours accumulation <45°F



A large wooden crate filled with many medium-sized red and yellow apples. The apples are densely packed and show a mix of red and yellow colors, indicating they are ripe. The crate is made of light-colored wood and is filled to the brim with the fruit.

**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

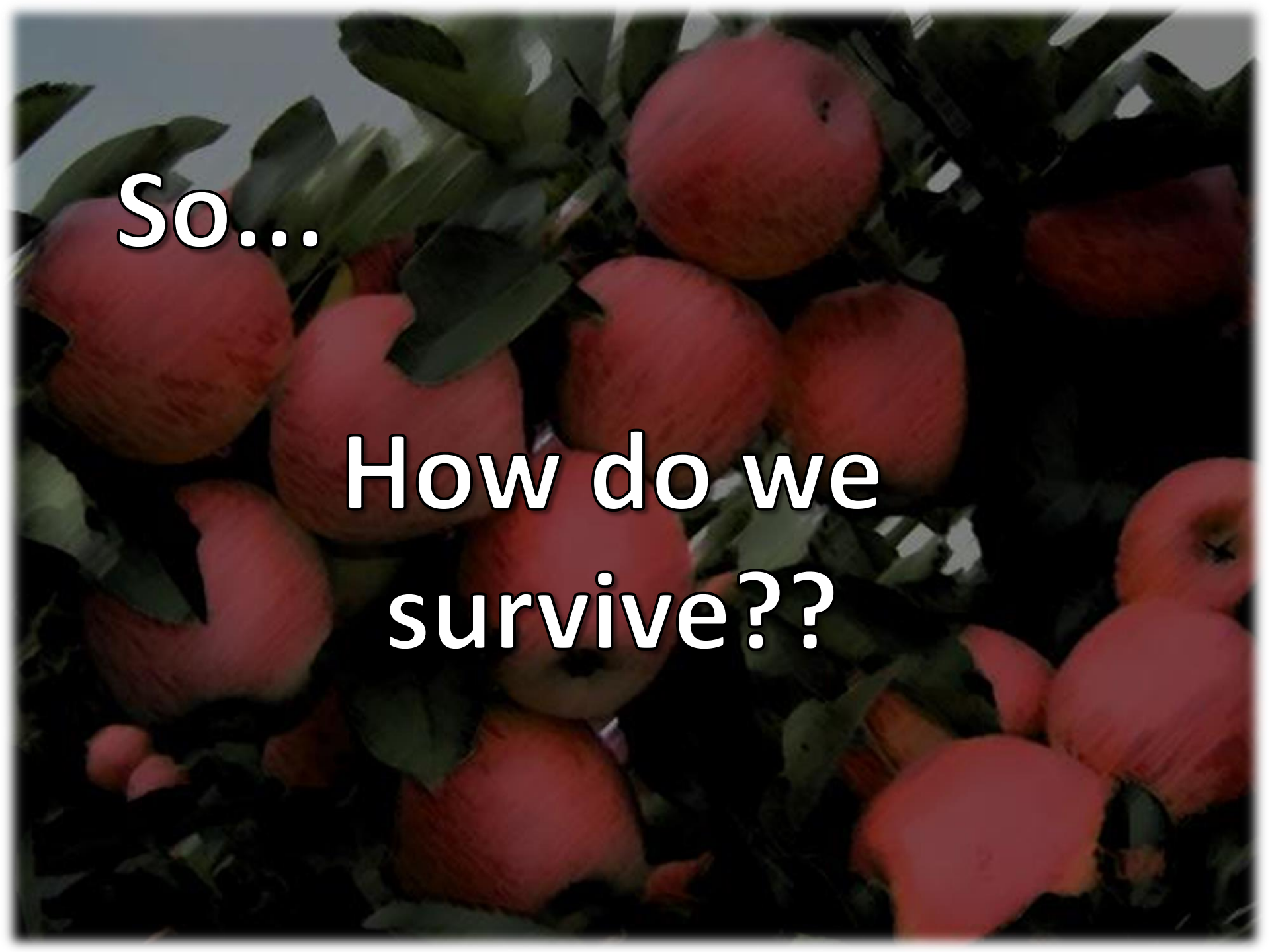


**São Joaquim**  
**1.350 m altitude;**  
**± 950 Chill hours**



**Fraiburgo**  
**980 m altitude;**  
**± 600 Chill hours**



A close-up photograph of a basket filled with ripe, red apples. The apples are clustered together, with some showing a slight yellowish-green tint. Green leaves are interspersed among the fruit. The lighting is soft, highlighting the texture of the apples' skin.

So...

How do we  
survive??

# Dormancy induction

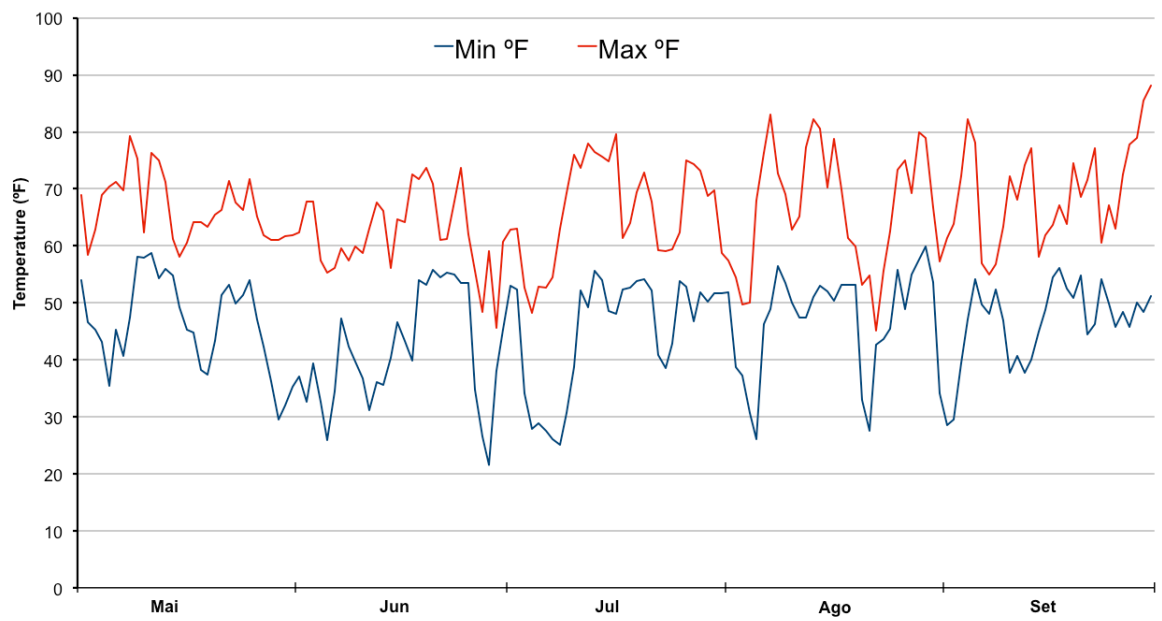
- As an adaptive process, temperate crops (fruit, grape) go through a dormant period.
- In sub-temperate climates, trees are not prepared for and thus present active metabolism during winter (leaves on shoot tips).
- **Defoliation:**
  - Urea
  - Cooper
  - ABA !!!





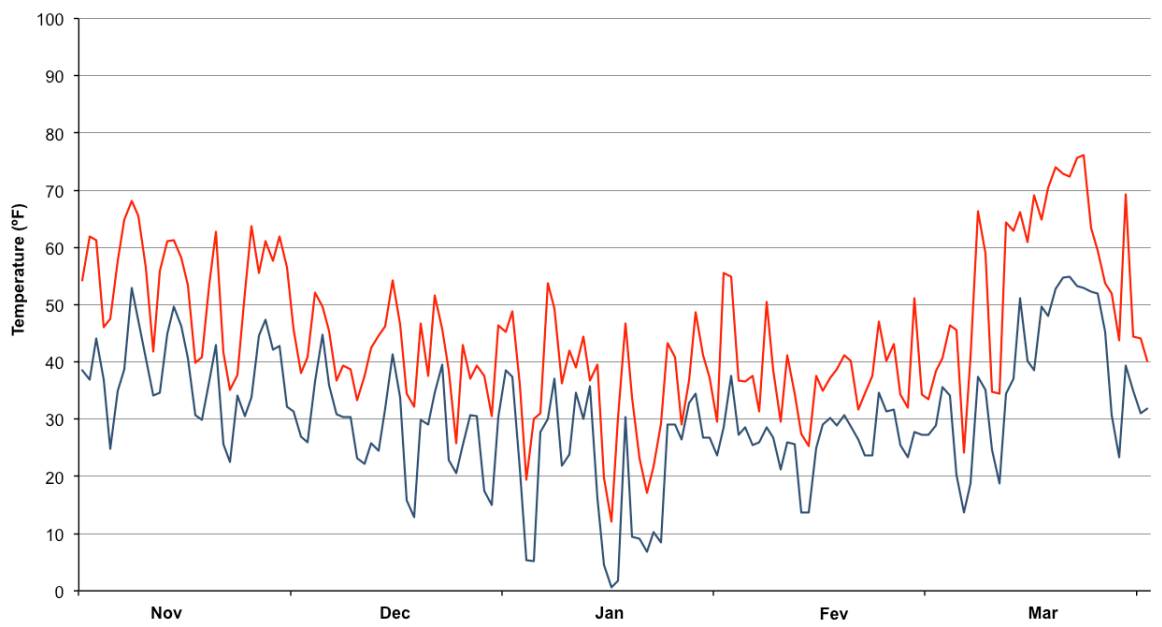
# Daily maximum and minimum temperatures during winter

*Caçador, SC – Brazil*



2011

*Geneva, NY – US*



# Dormancy Breaking Compounds

Silver tip stage:

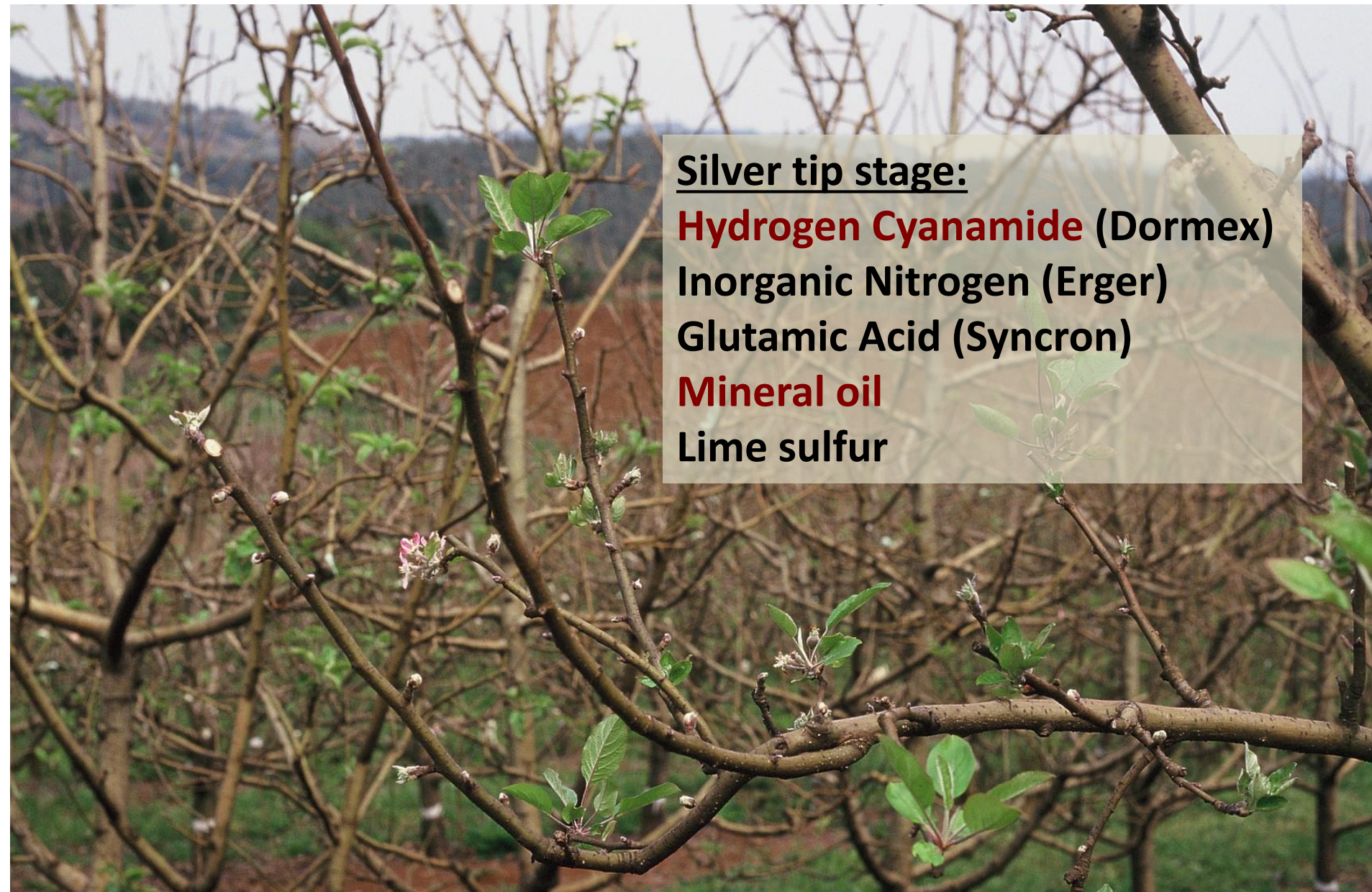
**Hydrogen Cyanamide** (Dormex)

Inorganic Nitrogen (Erger)

Glutamic Acid (Syncron)

**Mineral oil**

Lime sulfur



# Mechanisms of adaptation to “poor” winter conditions

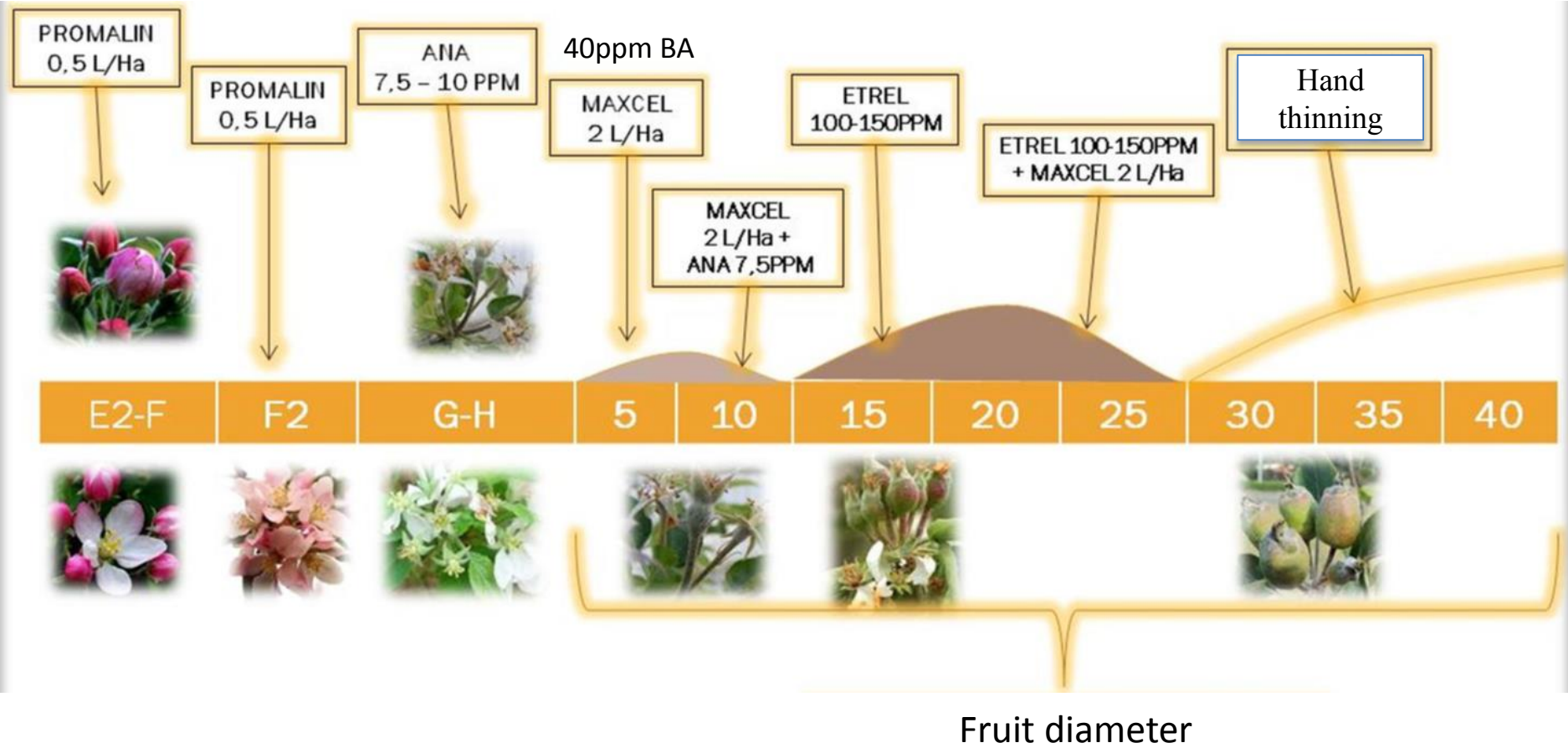
Bud Break



# Mechanisms Of Adaptation To Poor Fruit Set Conditions

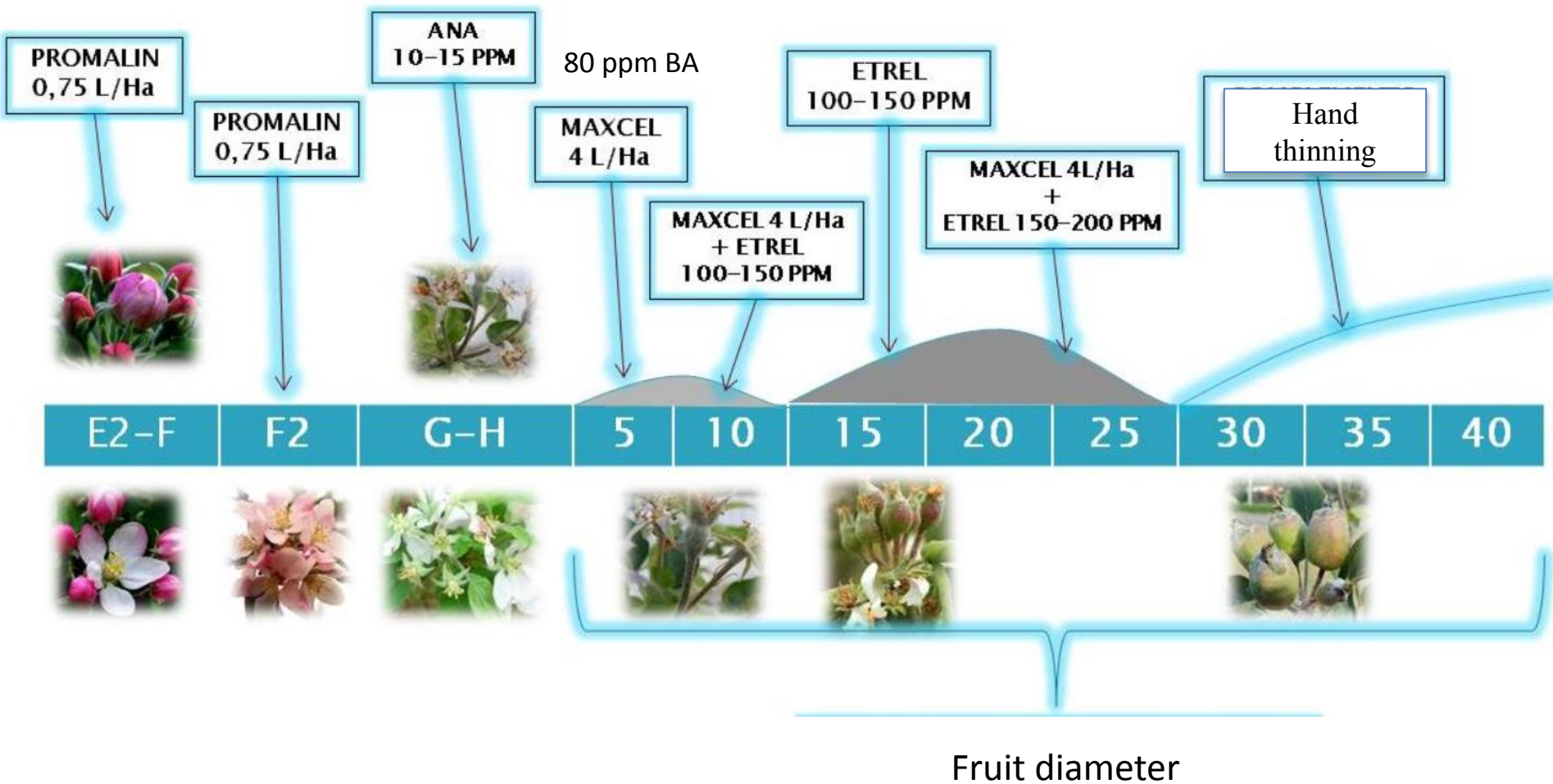
- TDZ – Cytokinin 10-15 ppm – Balloon stage ( $E_2$  – F);
- AVG – Retain (1/2 pouch to 2 pouch)
- Prohexadione calcium – Apogee – 2-14 oz (Full bloom);
- Trunk Girdling

# Thinning Strategies for Gala




~~Carbaryl~~

# Thinning Strategies for Fuji





**Warm and rainy summers – regrowth problems**



**Prohexadione Calcium (Viviful)  
Trinexapac-ethyl – (Moddus)**

**Long growing season Vigor control**



**Control**



**Prohexadione-Ca**



# Main apple diseases in Brazil

Spring

Sarna



Apple Scab

Powdery mildew



Oídio

Summer



MFG

Bitter rot (Glomerella)



Fruit rot



Marssonina

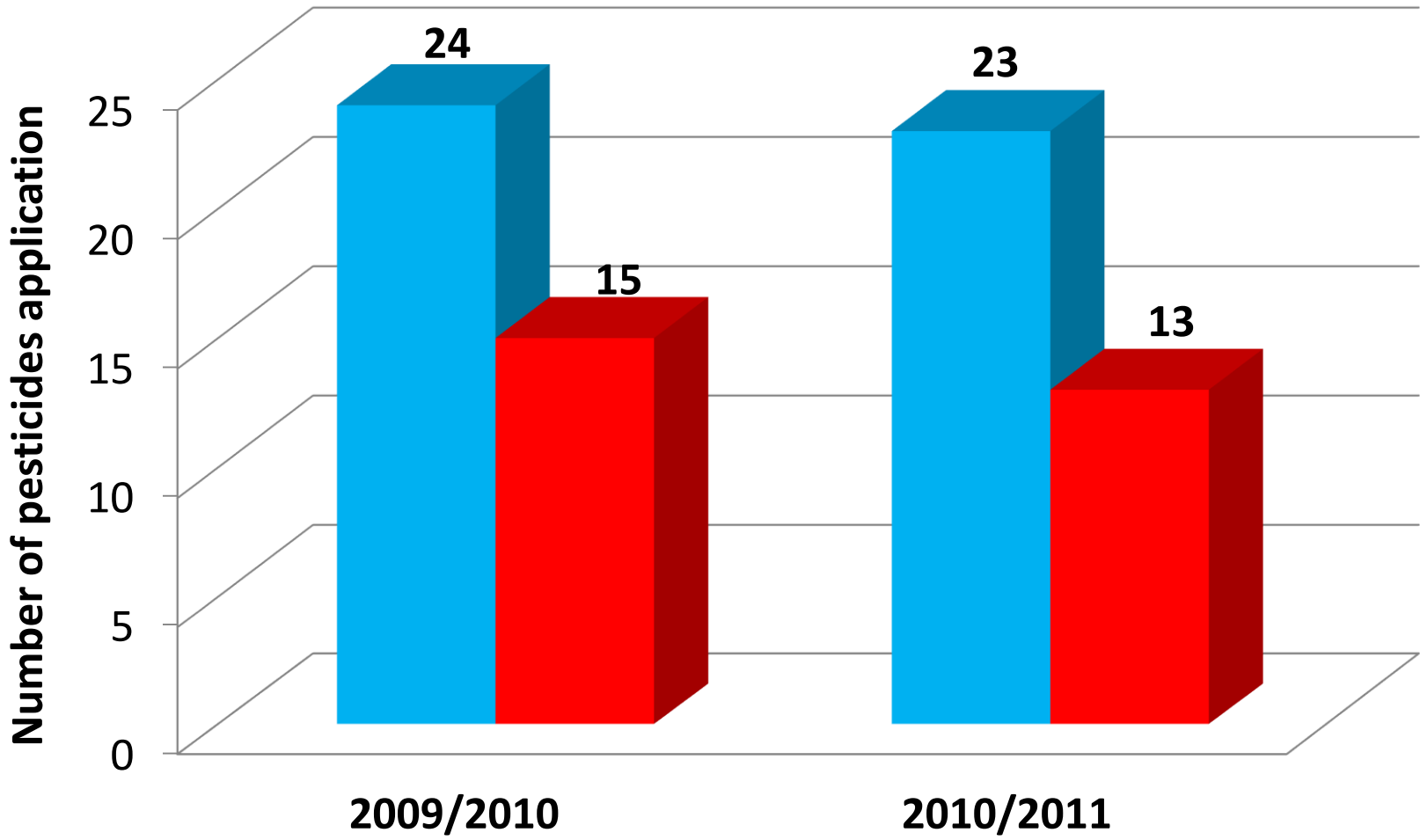
# European canker (*Nectria galligena*)

Since 2002  
Boom – 2012 to nowadays



~~Fire blight~~

**Gala e Fuji**    **Joaquina e Catarina**



# Orchard Systems



Central Leader



**Hilly and Flat areas**

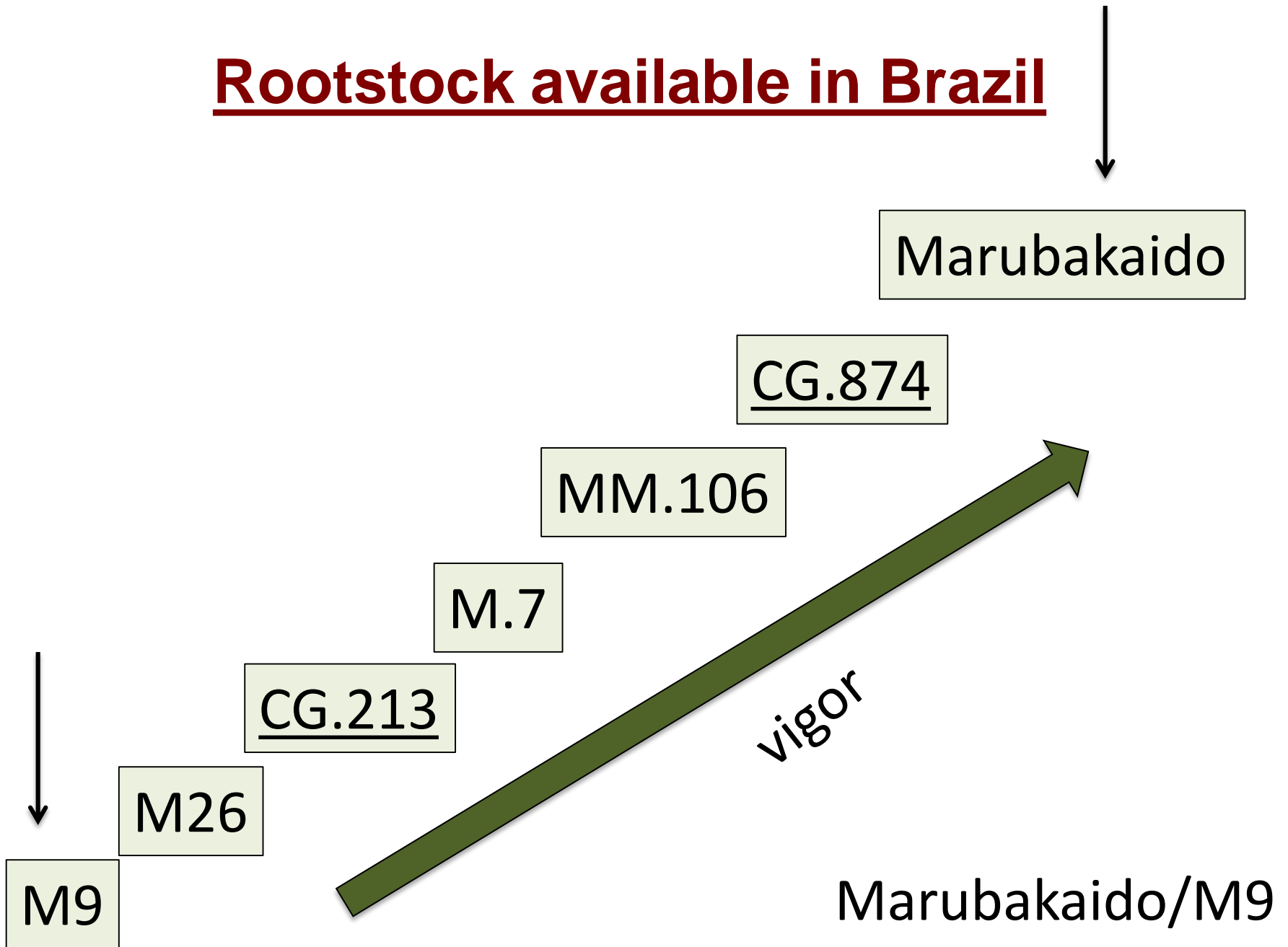
**Our largest Gala apples are located in the terminal bud of a one year old shoot**



**Gala**

Pruning

# Rootstock available in Brazil



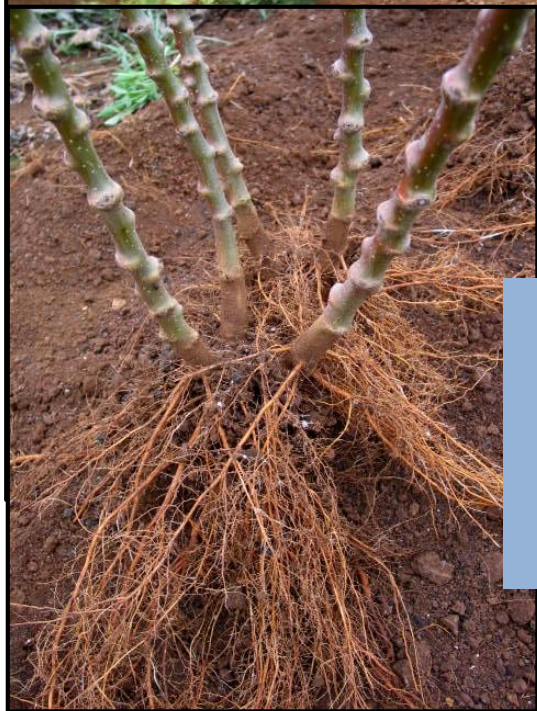


# CG.213

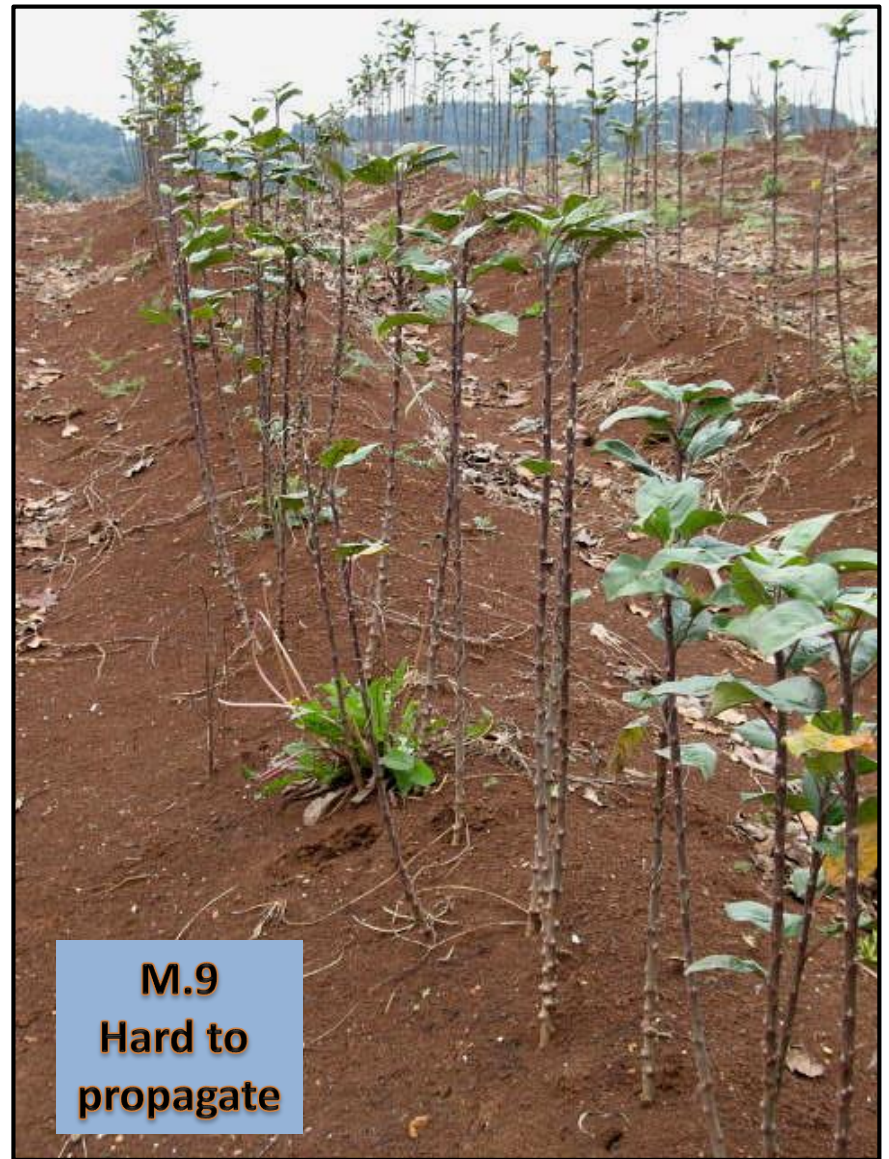
Otawa3 x Robusta 5

- 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**

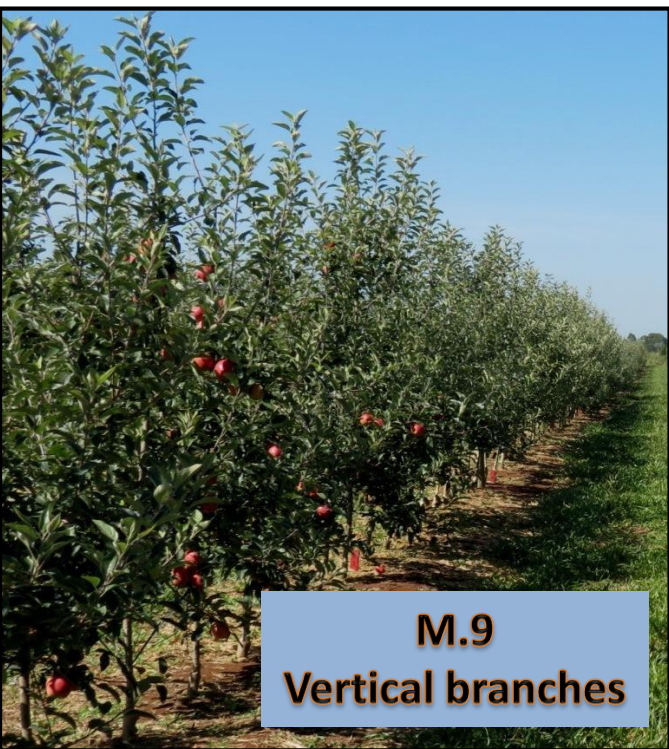


**M.9**  
**Hard to propagate**

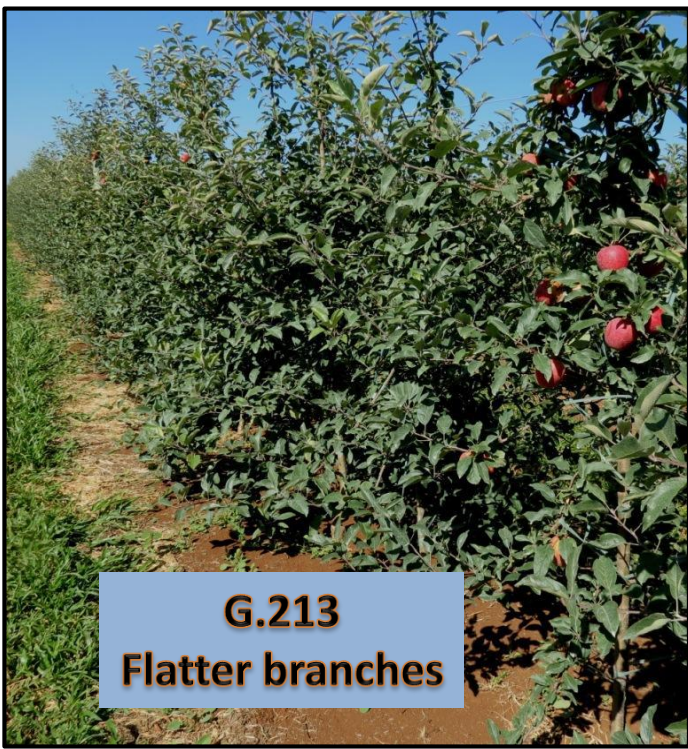
**G.213**

# 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

## CG.874

- Similar vigor to M.7
- Medium density orchards;
- Resistant to crown rot;
- Resistant to woolly apple aphid;
- few root suckers;
- no burrknots;
- Great performance in replanting areas;
- Requires tree support.

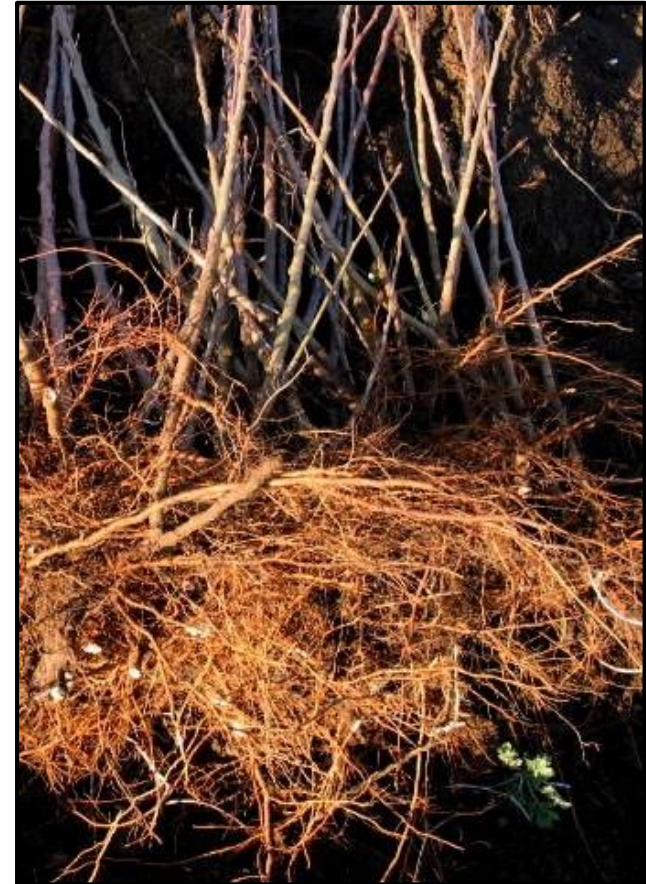


# Stoolbed

# Good rooting



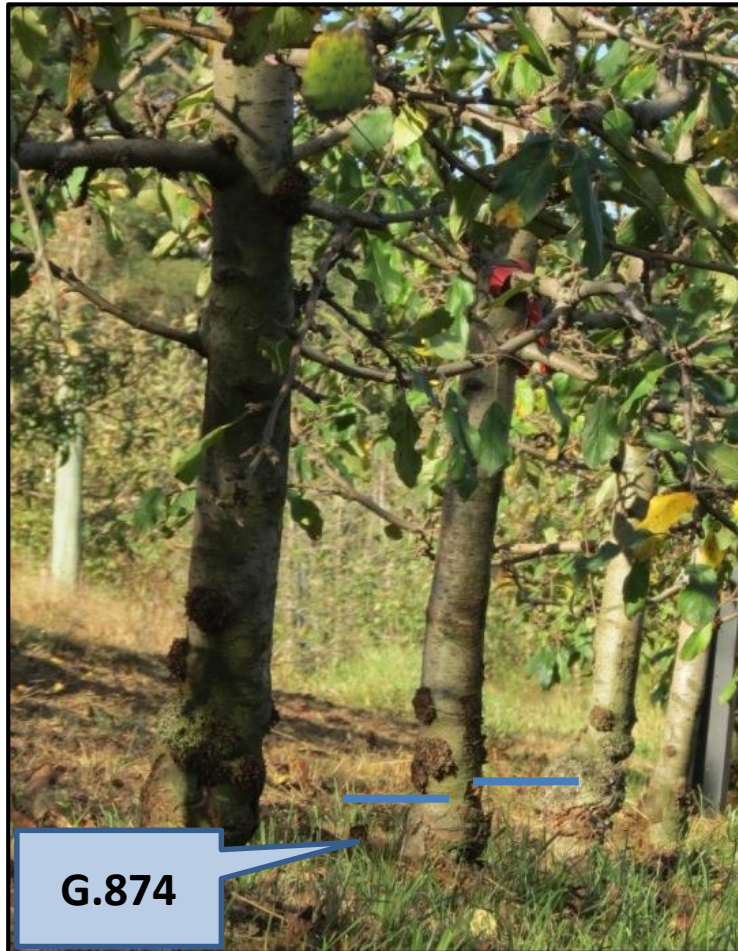
**M.7**  
Irregular liners



**G.874**  
Uniform 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**



**G.874**

**M-58/07**

**on CG-874**

**M-58/07**

**on Maruba/M-9**





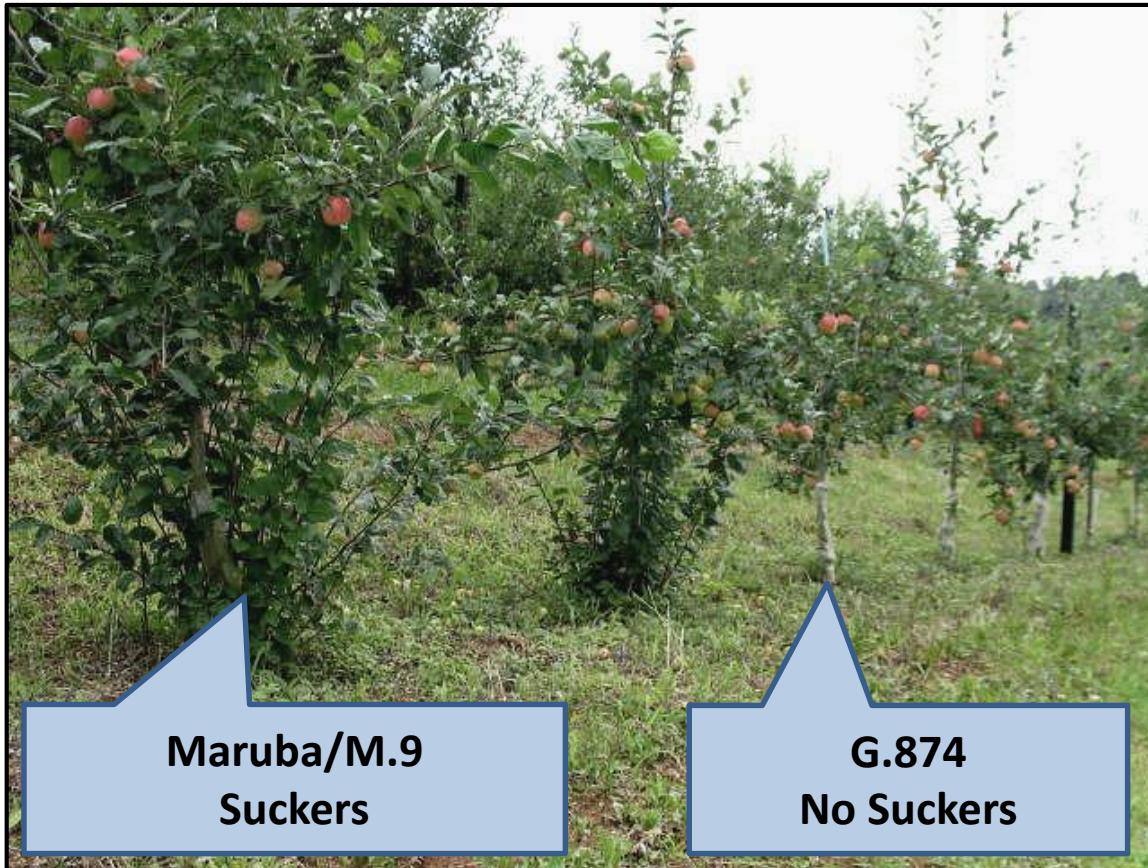
# Marubakaido

- 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



Maruba



M9



M9

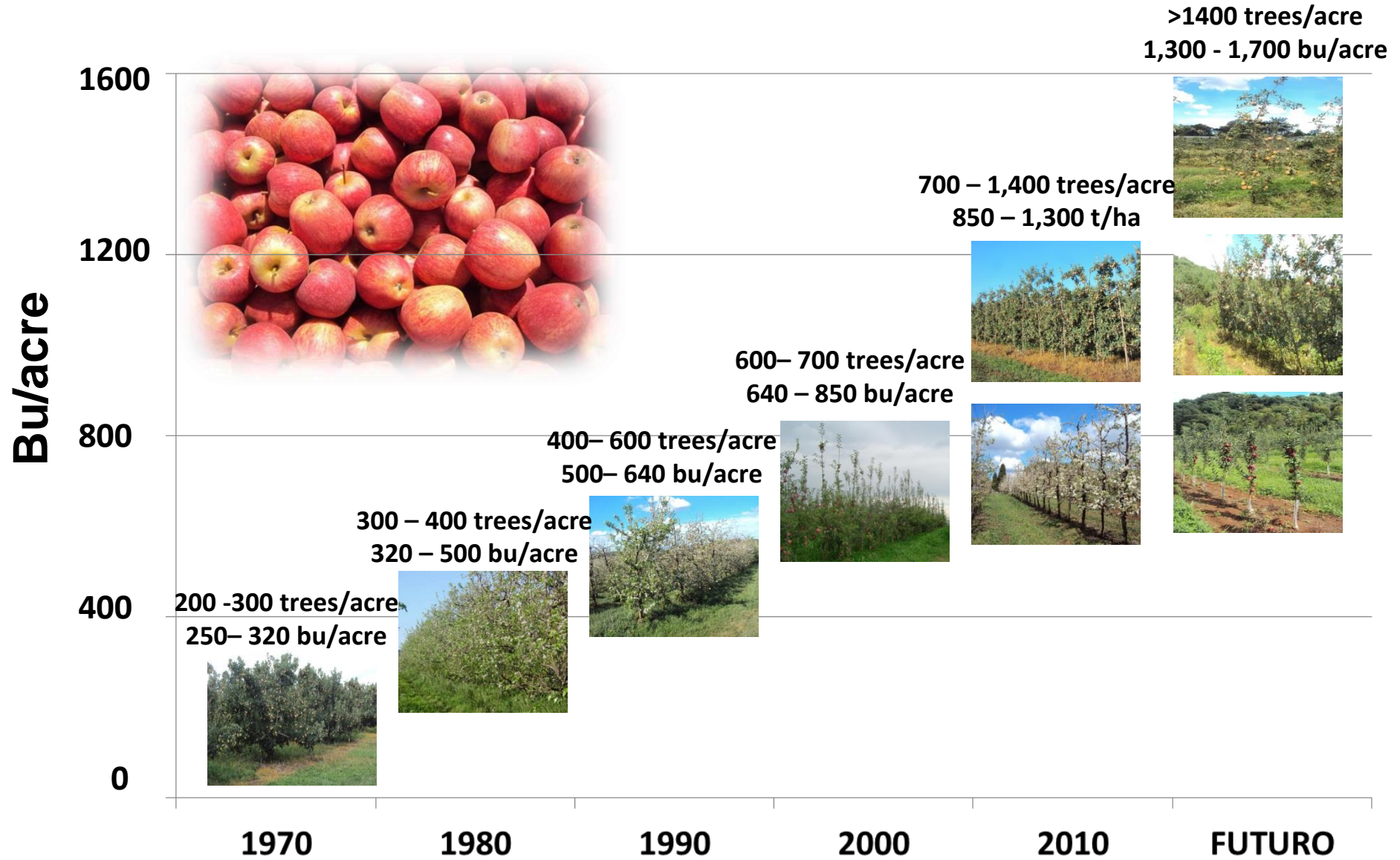
# TREE SPACING ACCORDING TO ROOTSTOCK/SCION

## Recommendation for Brazil

Rootstock	Vigorous cultivar		Standard (semi-vigorous)	
	Tree spacing	Trees/acre	Tree spacing	Trees/acre
<b>Dwarfs</b>	12 x 3	1,210	11 x 3	1,400
M-9, M-26, CG.4213	12 x 4	908	12 x 3	1,210
	13 x 5	670	13 x 4	838
<b>Semi-dwarfs</b>	13 x 5	670	13 x 3	1,117
M-7, MM-106	16 x 5	545	15 x 7	415
CG.874,	16 x 7	389	16 x 7	389
<b>Semi-vigorous</b>	16 x 8	340	16 x 8	340
MM-111	20 x 10	218	18 x 8	303
<b>Vigorous</b>	18 x 10	242	18 x 10	242
Marubakaido	20 x 11	200	20 x 10	218



# PAST AND CURRENT SITUATION OF THE APPLE PLANTING SYSTEMS, TREE DENSITY AND YIELD EFFICIENCY IN BRAZIL



A close-up photograph of a woven basket filled with ripe, red apples. The basket is placed on a branch of an apple tree, surrounded by lush green leaves. The apples are covered in small water droplets, suggesting they have been recently washed or are dew-covered. The background is a soft-focus green, indicating an orchard setting.

**Thank you!**

**Muito Obrigado!**