



**iconshare**

**in the field and beyond**



**iconshare**

**From a piece of land till a modern productive  
super-intensive orchard plantation. Ways to  
the success.**

**Hungarian Orchard Growers  
2017 Spring Conference**

# General Factors

- **Climate Conditions**
- **Soil Analysis**
- **Irrigation**
- **Soil Moisture**
- **Salinity**
- **Microclimate**
- **Surroundings**
- **Market Needs**



# General Factors

## Climate Conditions

### In Case of Early Spring Frost we Choose:

- Self-pollinated varieties
- Late flowering varieties



# General Factors

## Climate Conditions

### Altitude:

Different apple varieties in high or low altitude



# General Factors

## Climate Conditions

**Temperature difference between day and night:**

- Cherries need 400-800hr dormancy
- Peaches need 250-450hr dormancy



# General Factors

## Soil Analysis

Mechanical Composition

Clay soil → Vineyard, Almond  
Potato, Asparagus



# General Factors

## Soil Analysis

High Calcium Carbonate ( $\text{CaCO}_3$ )

In peach and almond trees we choose the rootstock GF677 to avoid Iron(Fe) and Zinc(Zn) deficiencies





# General Factors

## Soil Analysis

Ph

High



Potato, Chestnut

Vineyard Rootstock:

Richter110

Paulsen 1103

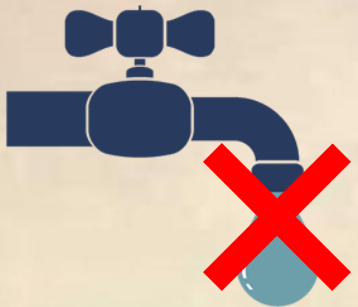


# General Factors

## Irrigation



Gizela 5/6 Rootstock



Mazzard Seedling Rootstock



# General Factors

## Soil Moisture

Moisture  
conditions



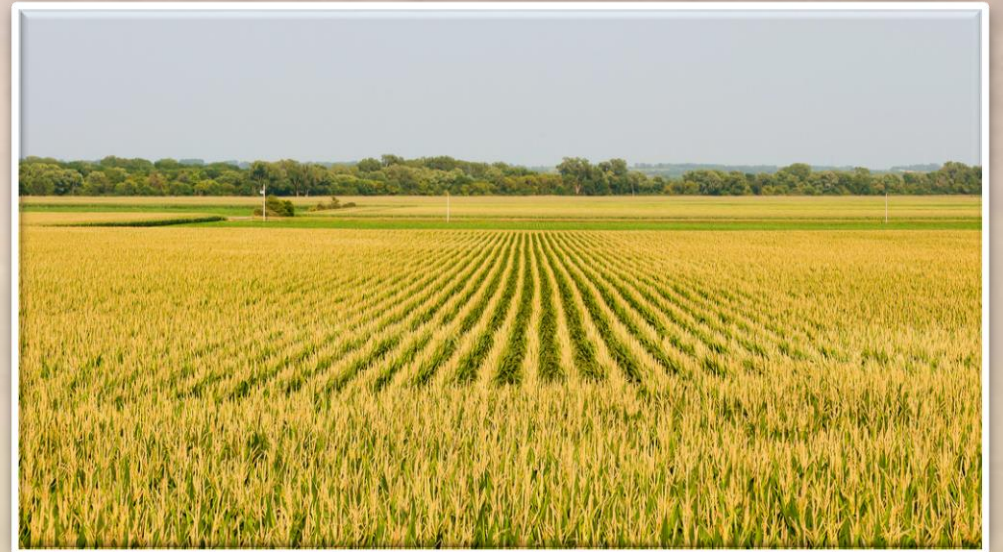
Rootstock: Cap6, Plums  
Rootstock: C29 Apricot  
Peaches, Cherries



# General Factors

## Salinity

High Salinity  Orchards (Cherries)  
Field Crops (Corn, Grain)

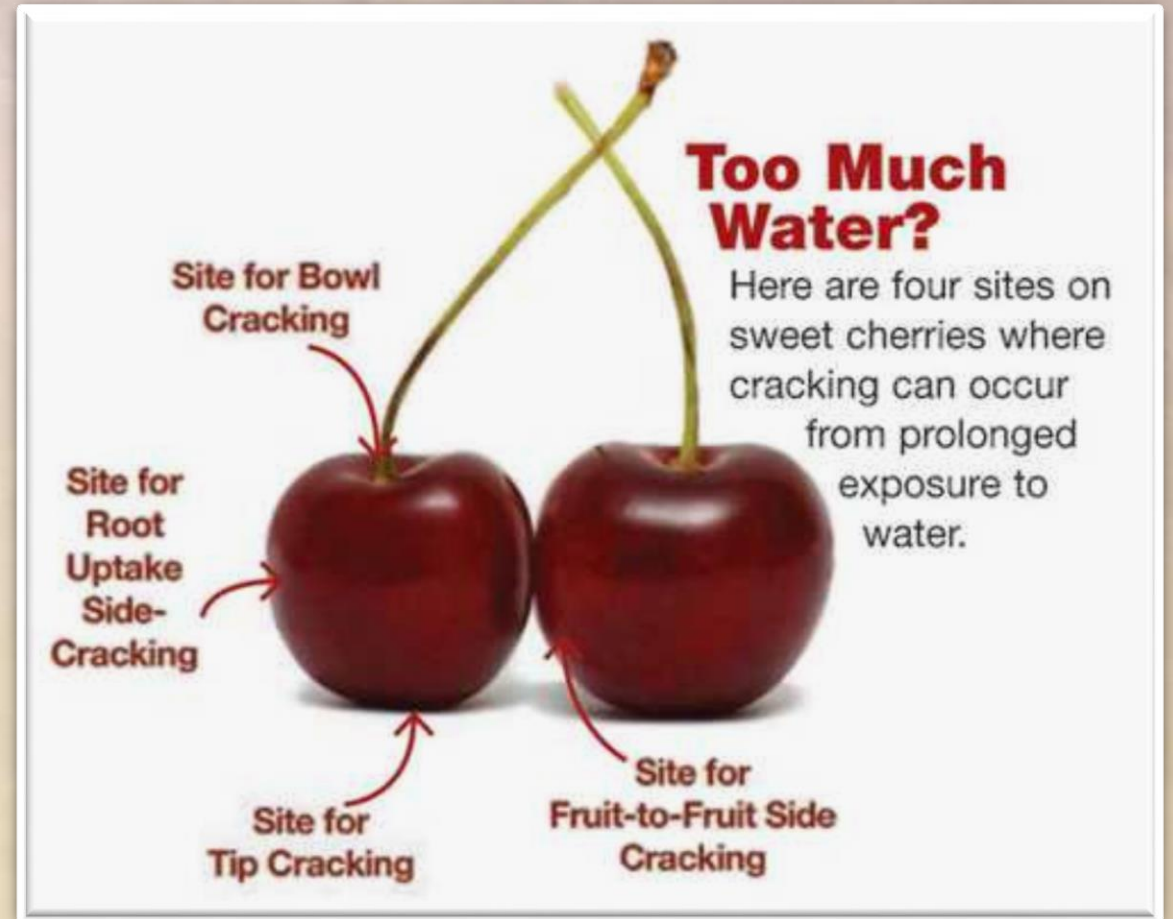


# General Factors

## Microclimate

### Rainfalls

Cherry varieties that don't mature (resistant to cracking like Black Star) the same period that rainfalls occurs in the area will crack due to the prolonged water exposure.



# General Factors

## Microclimate

### Wind

- Sensitive sprouts that break in kiwis
- Helps in the olive tree pollination
- Sensitive fruits that fall in strong winds



# General Factors

## Microclimate

Day and night temperature difference

Combination of low day temperatures and high night temperatures promote the increased production of anthocyanins which are responsible for the best coloring of the fruits



# General Factors

## Microclimate

Day and night temperature difference

Tomatoes best coloring temperatures:

- $\geq 15^{\circ}\text{C}$
- $\leq 30^{\circ}\text{C}$





# General Factors

## Surroundings

Situating plantings away from forest edges may also reduce predation by birds, and will assist with pollination and disease prevention through good air circulation.



# General Factors

## Market Needs

What is Better?

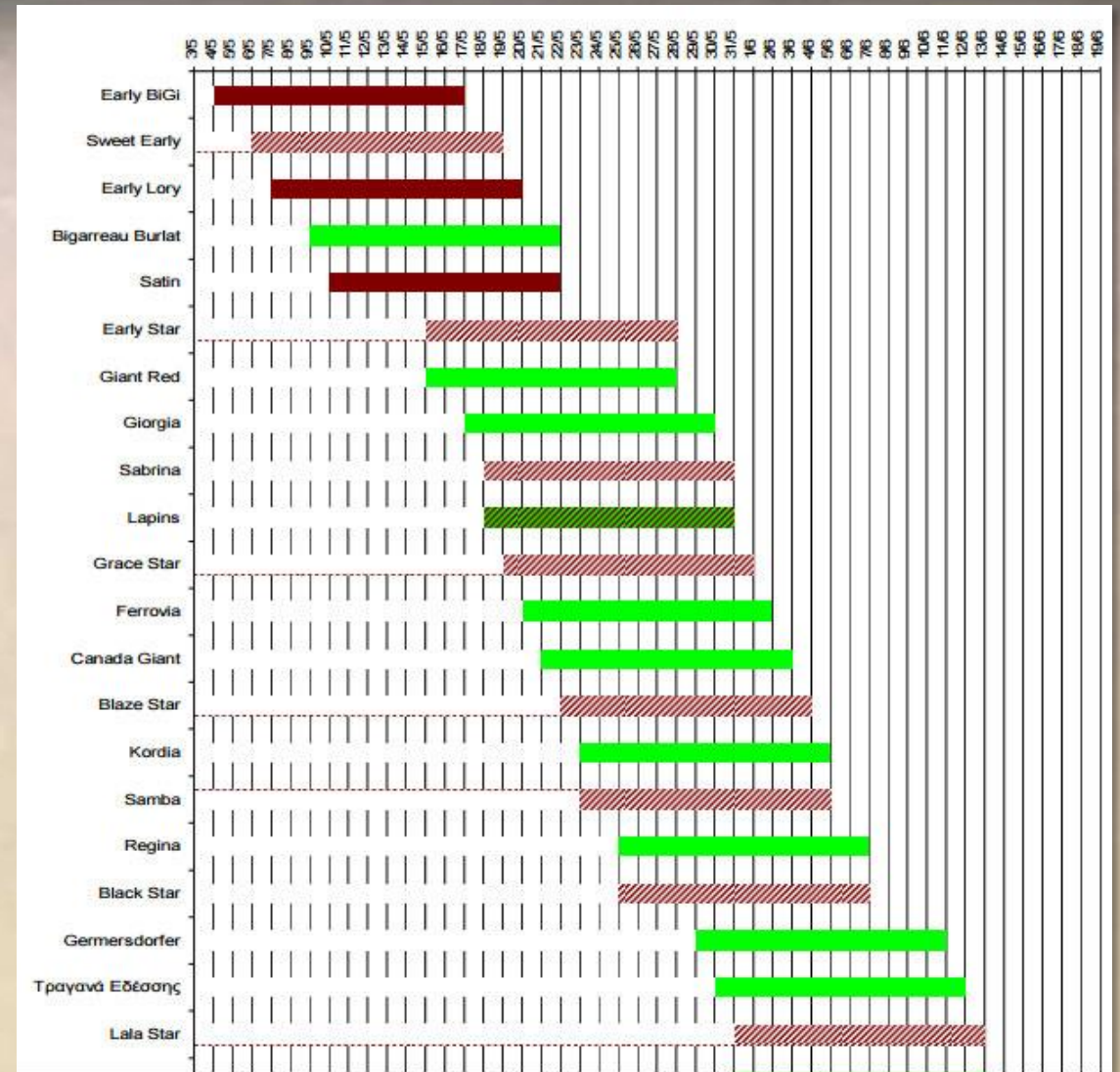
Earlier Production?  
or  
Higher Quality?



# General Factors

## Cherry varieties mature timeline

- Early Bigi 4/5 – 17/5
- Sweet Early 6/5 – 19/5
- Giorgia 17/5 – 30/5
- Grace Star 19/5 – 1/6
- Black Start 25/5 – 7/6
- Lala Star 31/5 – 13/6



# Cherry Orchard

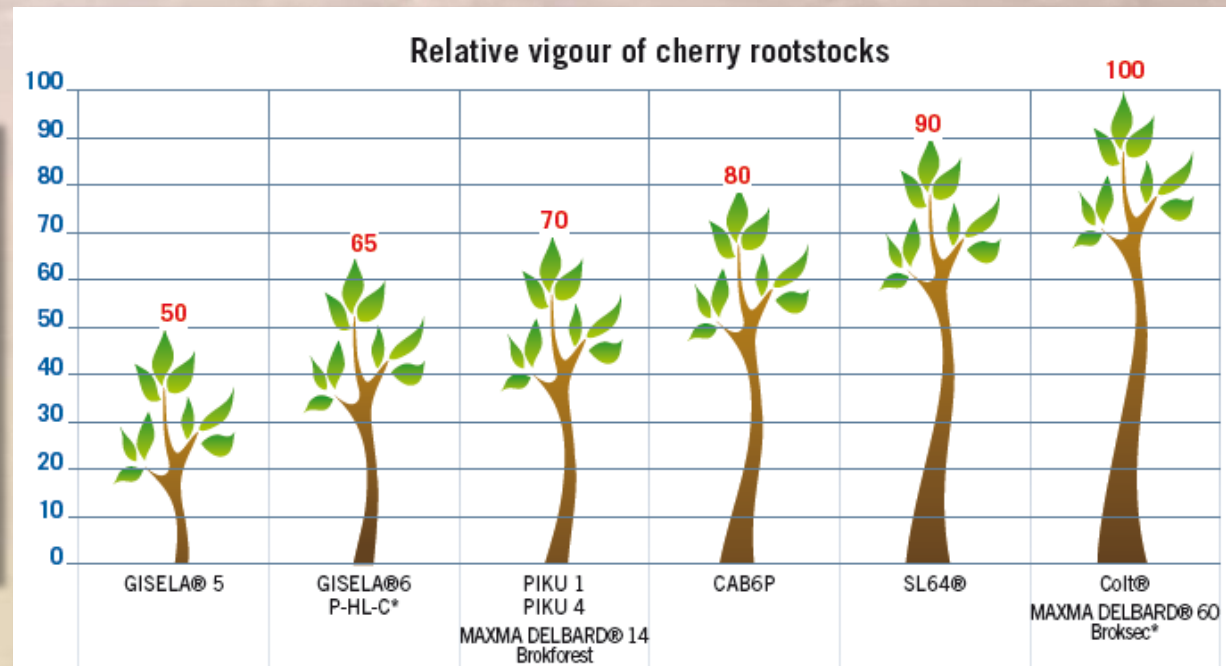


Ripening dates of cherries (relative to Burlat)  
in Emilia-Romagna Burlat ripens on May 25th

	Variety	May	June	July
-7	PRIMULAT® Ferprime*	●	●	
-3	EARLY LORY® 1789 NV*	●	●	
0	BURLAT	●	●	
+6	LORY BLOOM® 1788 NV*	●	●	
+7	SABRINA® SUMN314CH		●	
+8	FEU 5®		●	
+9	GIORGIA		●	
+10	FOLFER*		●	
+10	SAMBA® Sumste*		●	
+10	LORY STRONG® 1786 NV*		●	
+12	BIG LORY® 1787 NV*		●	
+12	FERDOUCE*		●	
+12	CELESTE® Sumpaca*		●	
+15	FERTILE*		●	
+16	NEW MOON® Sumini*		●	
+18	FERMINA*		●	
+18	SIMCOE® Probia*		●	
+19	SONATA® Sumieza*		●	
+20	VAN		●	
+20	CANADA GIANT® Sumgiza*		●	
+20	SATIN® Sumele*		●	
+22	FERNIER*		●	
+23	FERROVIA		●	
+24	KORDIA		●	
+24	LAPINS		●	
+25	BIG STAR®		●	
+30	SKEENA*		●	
+30	FERDIVA*		●	
+30	REGINA		●	
+35	SWEETHEART® Sumhare*		●	
+40	FERTARD*		●	
+45	LATE LORY®		●	

# Cherry Orchard

training system	rootstock	tree spacing	trees/ha
vase	Colt, MaxMa Delbard@14	5-5,5 x 3-4	450-670
Catalan vase	Colt, MaxMa Delbard@14	4,5-5 x 2,5-3	670-890
palmette	MaxMa Delbard@14, Gisela 6	4-4,5 x 3-3,5	740-1000
slender spindle	Gisela 5 e Gisela 6, Piku 1 e 4, P-HL-C	3,5-4 x 1,5	1670-2850
pillar	Gisela 5 e Gisela 6, Piku 1 e 4, P-HL-C	3-3,5 x 0,5-1	2850-3330
perpendicular V or Y	Gisela 5 e Gisela 6, Piku 1 e 4, P-HL-C	4-4,5 x 1-1,5	1480-2500



# Cherry Orchard

	Free Systems	Linear Systems	
Rootstock	Vase - Cypress	Palmette - Fence	Super Slender Axe
Wild Cherry Rootstock	6x6 – 8x8	-	-
Maxma 60	6x6 – 8x8	-	-
Mahaleb Rootstock	6x6 – 7x7	-	-
Colt	5x5 – 6x6	4x5 – 4,5x5	-
CAB-6P	5x5 – 6x6	4x5 – 4,5x5	3x5 – 4x5
Maxma 14	5x5 – 6x6	4x5 – 4,5x5	3x5 – 4x5
Gisela 6	-	3,5x4,5 – 4x4,5	1,5x4,5 – 2,5x4,5
Gisela 5	-	3,5x4,5 – 3,5x4,5	0,80x4,5 – 1,5x4,5

# Cherry Orchard

Gisela 6 Rootstock + Lapins Variety = ❌

Lapins Variety + Mazzard Rootstock = ✅

Mazzard Rootstock + Greystar Variety = ❌

Greystar Variety + Gisela 6 Rootstock = ✅



# Cherry Orchard

## Advantages and Drawbacks of High-density Sweet Cherry Systems

- Early bearing
- High yields
- Harvest efficiency and ease
- Tree efficiency (light and spray distribution)
- Easy to protect with covers





# Cherry Orchard

## Advantages and Drawbacks of High-density Sweet Cherry Systems

- Fruit quality?
- Early return on investment and breakeven cost?



# Cherry Orchard

## Advantages and Drawbacks of High-density Sweet Cherry Systems

- High establishment cost
- High level of inputs (training labor)
- High level of knowledge
- Must protect from frost since trees are smaller
- Short lifespan?



# Cherry Orchard



# Cherry Orchard



# Cherry Orchard

Narrow “Fruiting Wall” Canopies for Space Efficiency under Protective Structures



# Cherry Orchard

## Cherry Systems Fundamentals: Growth and the Basic Fruiting Units



Understanding this basic set of leaf populations and fruiting sites is a fundamental key to all training systems

# Cherry Orchard

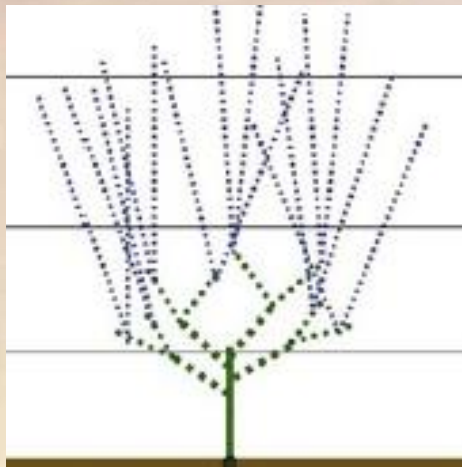
High Performance Orchards: Precisely-Structured Trees with Simplified Fruiting Units



# Cherry Orchard

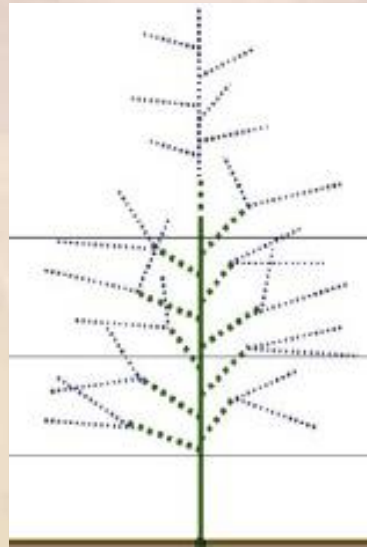
## Sweet Cherry Intensive Installation Systems

KGB



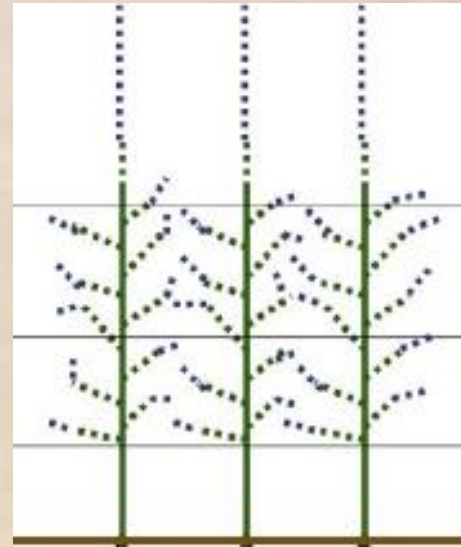
**Kym Green Bush**

TSA



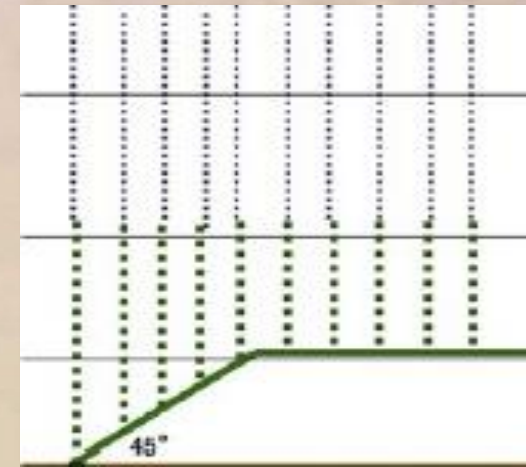
**Tall Spindle Axe**

SSA



**Super Slender Axe**

UFO



**Upright Fruiting Offshoots**

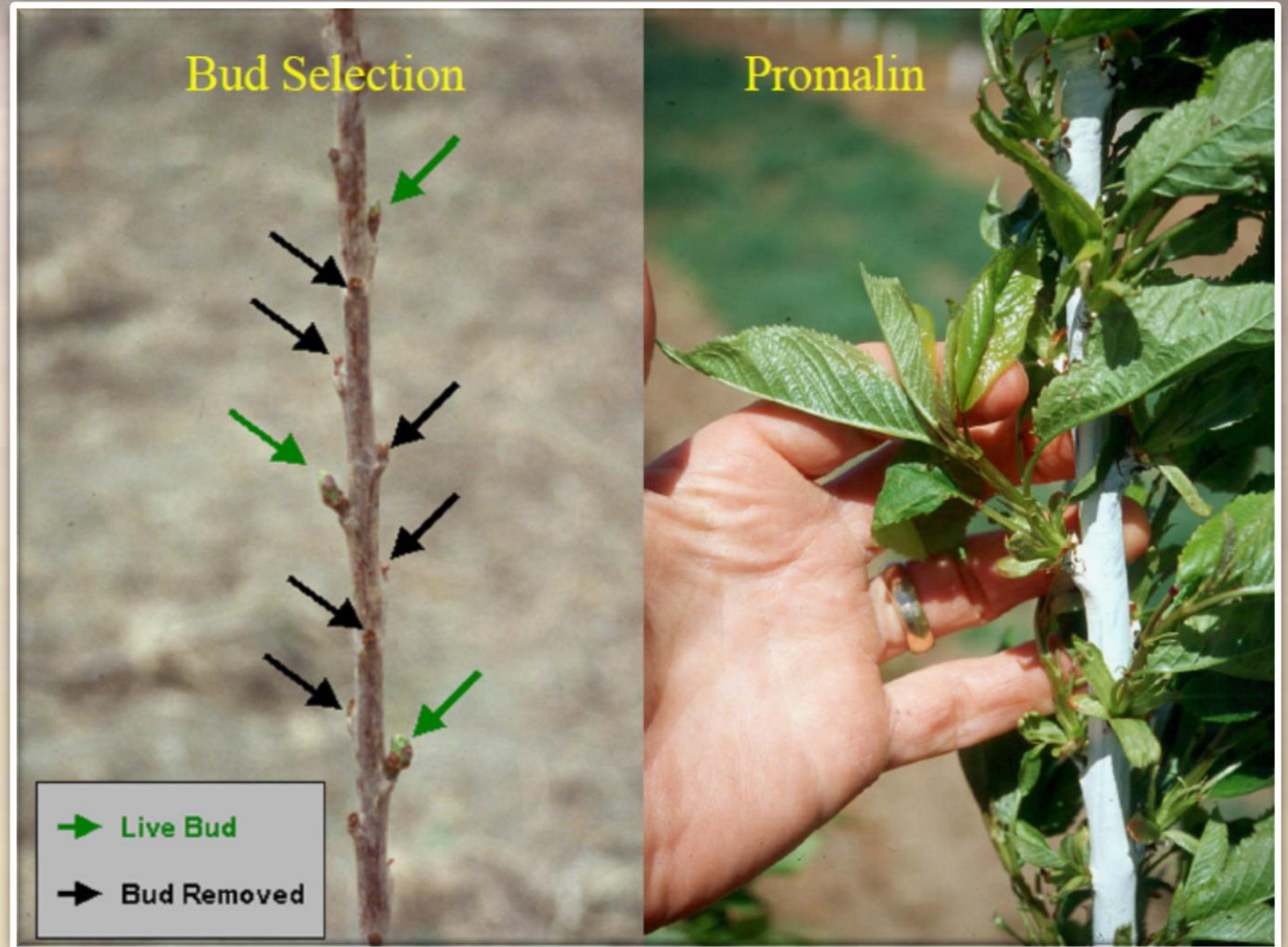


# Cherry Orchard

## Shoot Promotion

The goal in forming shoots in Years 1-2 should be to establish fruiting units for Years 2-4:

- Heading (not desirable)
- Promalin (sensitive to climate)
- Bud selection
- Bud notching/scoring (susceptible to bacterial cancer)



# Cherry Orchard

Super Slender Axe (SSA)



# Cherry Orchard

## Super Slender Axe (SSA)

Nursery Trees

Spacing: 2.5 x 11 ft

100-120 cm in height from the graft union, strong buds, moderate internode spacing



# Cherry Orchard

## Pruning Regime for SSA Training

- Establishing adequate fruiting units is key to SSA success.
- Most SSA cropping occurs on basal non-spur flowers of year-old shoots.
- Thus, each SSA tree must have an adequate number of fruiting units (new shoots) that are uniformly arrayed along the central leader and have uniform, moderate vigor.
- SSA tree structure should be fully developed by the end of Year 2.



# Cherry Orchard

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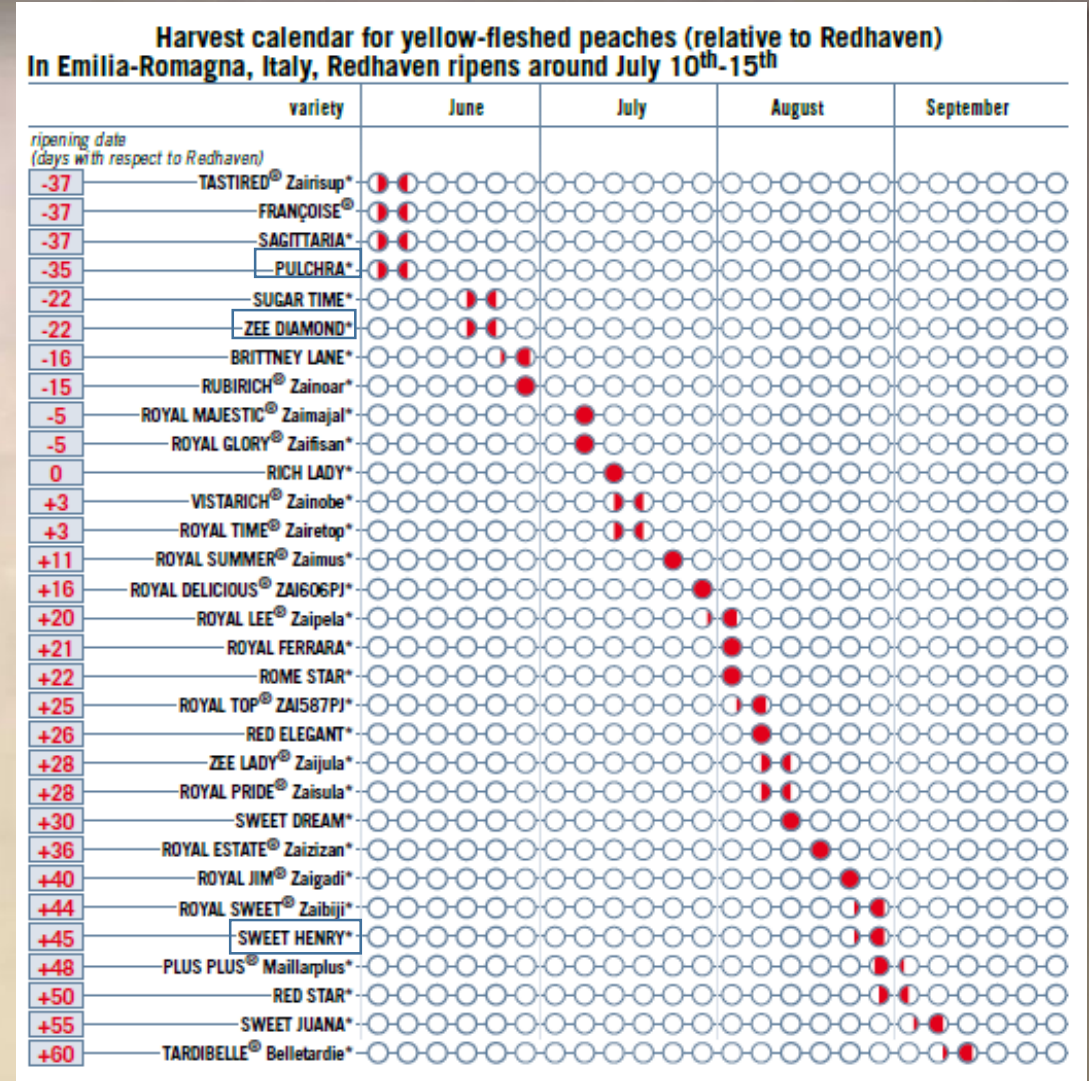


# Cherry Orchard

There is no single best system. Growers who will be successful if they understand the fundamental training rationale and fruiting units for each system, and how to adapt their system management for their specific needs: their orchard site, their variety characteristics, their markets, and their labor situation.



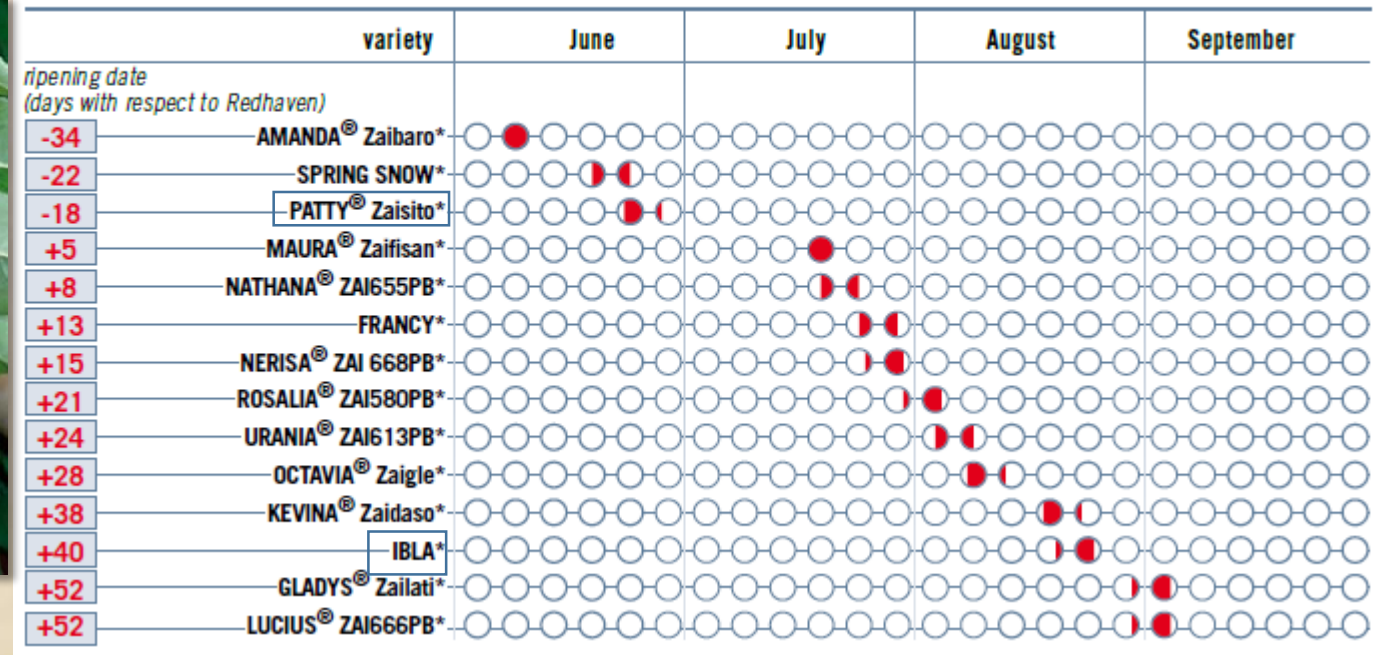
# Peach Orchard



# Peach Orchard



Harvest calendar for white-fleshed peaches (relative to Redhaven)  
In Emilia-Romagna, Italy, Redhaven ripens around July 10<sup>th</sup> -15<sup>th</sup>

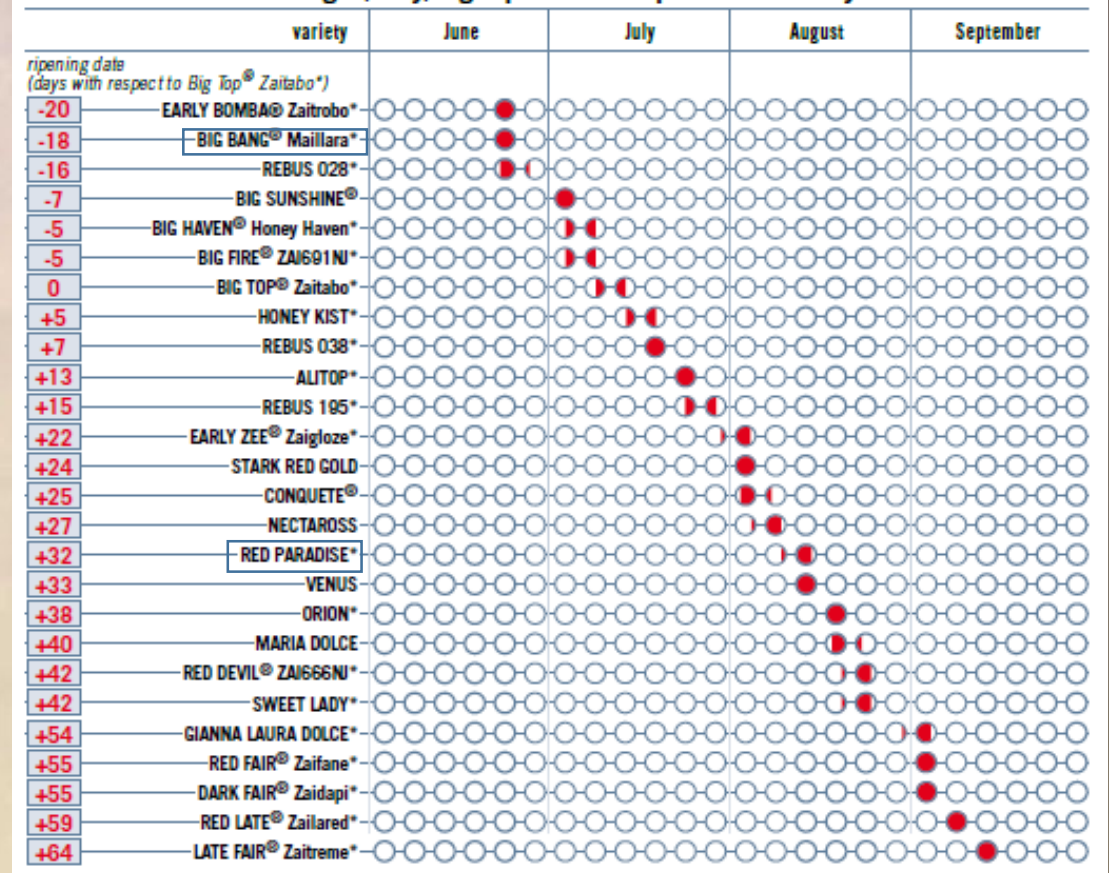




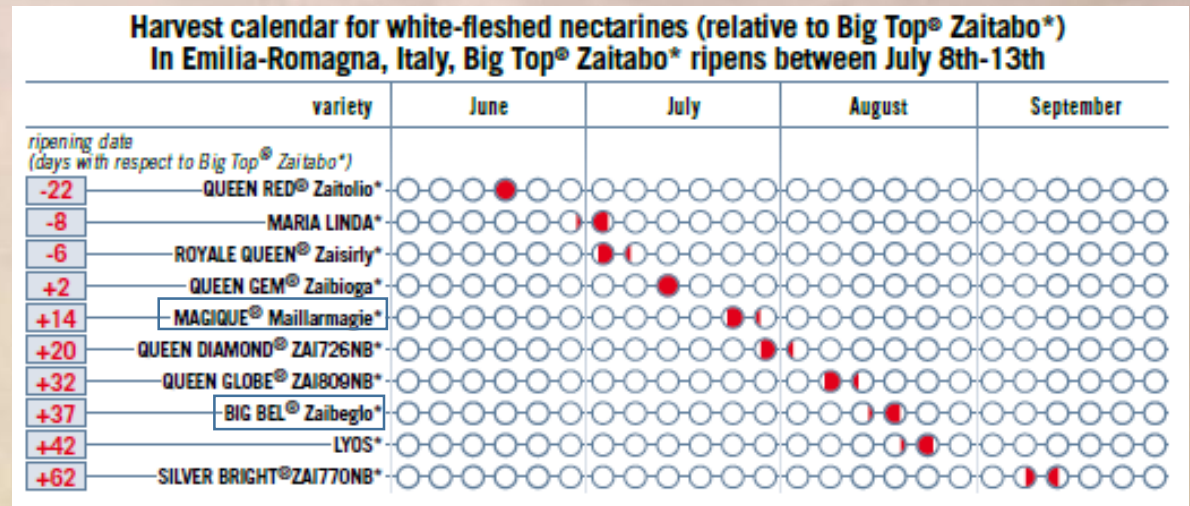
# Peach Orchard



Harvest calendar for yellow-fleshed nectarines (relative to Big Top® Zaitabo\*)  
In Emilia-Romagna, Italy, Big Top® Zaitabo\* ripens between July 8th-13th



# Peach Orchard

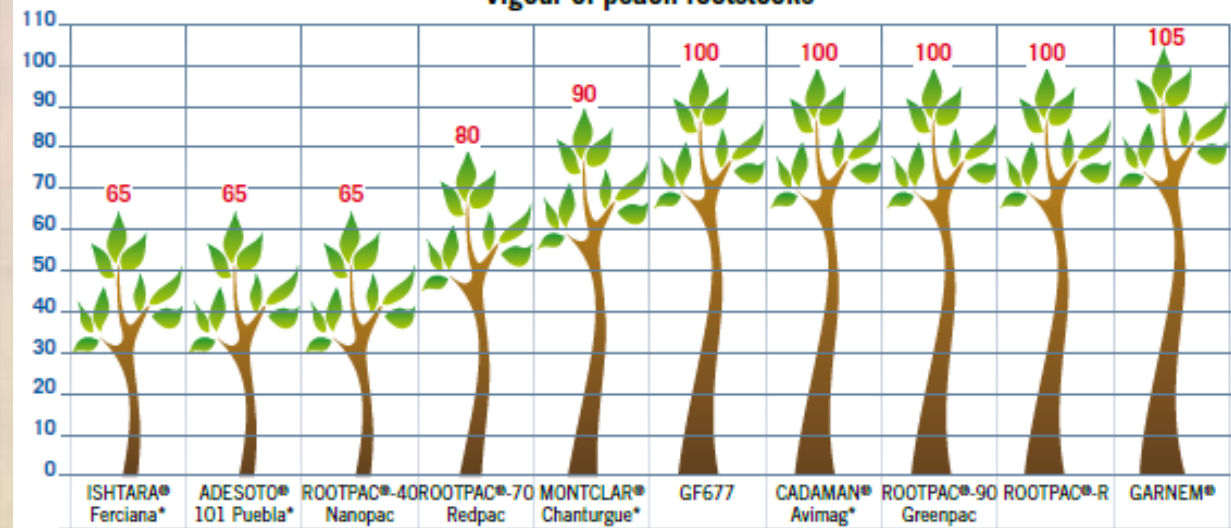


# Peach Orchard

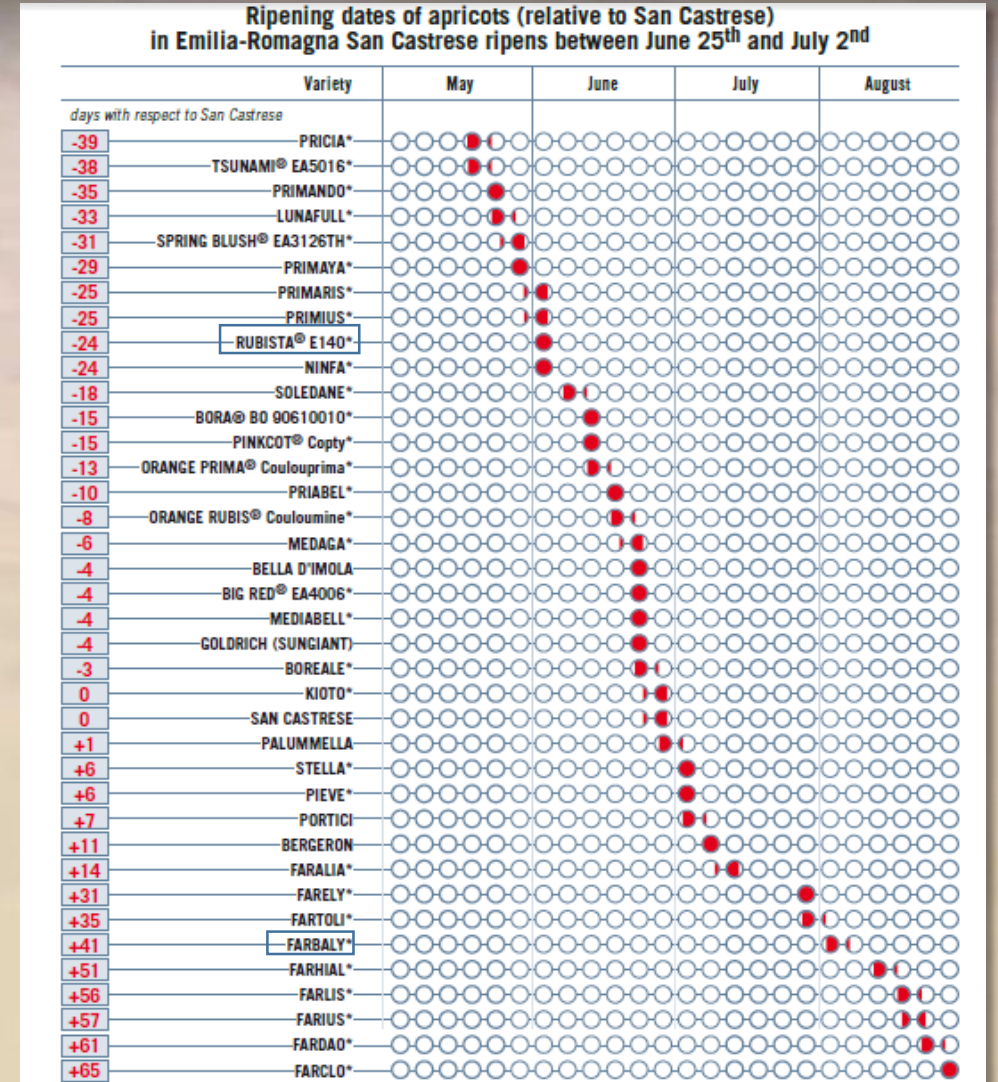
## Training systems and tree density

tree form/shape	tree spacing (m)	trees/ha
vase	5-5,5 * 3-4	450-660
palmette	4-4,5 * 3-3,5	630-830
candelabra	4-4,5 * 3-3,5	630-830
Catalan vase	4,5-5 * 2,5-3	670-890
U-shape	4-4,5 * 2-3	740-1250
slender spindle	4,5-5 * 1,5-2	1000-1500
trellised-Y	5 * 1,5	1330
super spindle	4-4,5 * 1-1,2	1850-2500

## Vigour of peach rootstocks



# Apricot Orchard

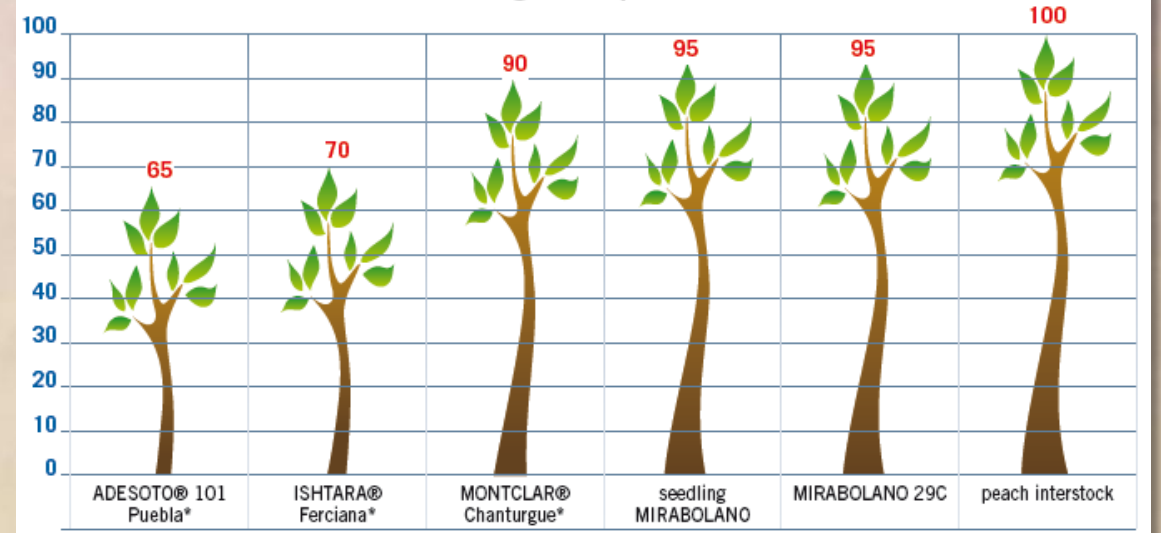


# Apricot Orchard

## Training systems and tree density

tree form/shape	tree spacing (m)	trees/ha
vase variants	5-5,5 * 3-4	450-660
Catalan vase	4,5-5 * 2,5-3	670-890
palmette	4-4,5 * 2,5-3	740-1100
trellised Y	4-4,5 * 2-2,5	890-1250
slender spindle	4-4,5 * 1,5-1,8	1230-1660
perpendicular V or Y	5 * 1,5	1330
pillar	4-4,5 * 1-1,2	1850-2500

Relative vigour of apricot rootstocks



# Apricot Orchard

## Training systems

Traditional  
(vase)

Central  
Axe



- Less plants/ha
- More years to enter full production
- Pruning once/year

- More plants/ha
- Full production at 3<sup>rd</sup> leaf
- Pruning 3 times/year
- Higher productivity

# Apricot Orchard

## Traditional Vase



# Apricot Orchard

Palmette





# Apricot Orchard

Central Axe



# Apricot Orchard

UFO



# Apple Orchard



**Ripening dates of apple varieties (relative to Golden Delicious clone B)  
in Emilia-Romagna Golden Delicious clone B ripens September 15th**

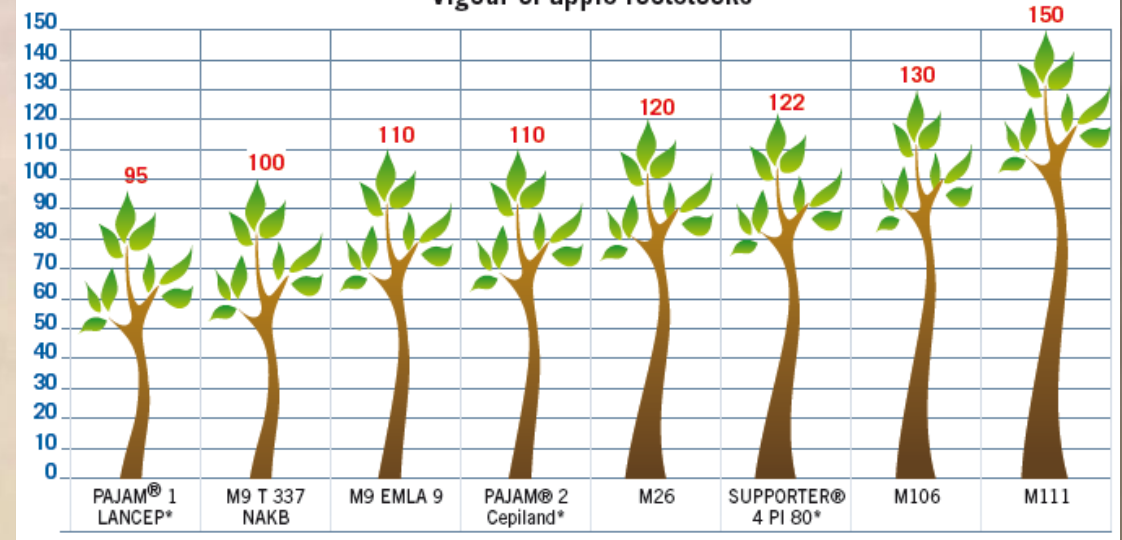
Variety	July	August	September	October
days with respect to Golden Delicious clone B	● harvest date		● ripening date	
-30 -TR- SUMMERFREE*			●	
-27 DEVIL GALA*	●		●	
-27 ANNAGLO*	●			
-27 RUBY GALA® Gala rossa*	●	●		
-27 ROYAL BEAUT® Proselect*	●	●		
-27 SCHNIGA® Schnitzer*		●	●	
-27 GALAXY® Selecta®		●	●	
-12 RED CHIEF® Campsur*			●	
-10 EARLY RED ONE® Erován*			●	
-10 JEROMINE*			●	
-10 RED CAP® Valtod*			●	
-10 SCARLET SPUR® Evasri*			●	
-10 SUPERCHIEF® Sandidge*			●	
-10 RENETTA DEL CANADA			●	
-8 -TR- CRIMSON CRISP® Coop 39*				●
0 GOLDEN Clone B			●	
0 GOLDEN Clone B LB*			●	
0 GOLDEN SMOOTHIE® CG10YD*			●	
0 GOLDEN 527®			●	
0 GOLDEN RUGGINE			●	
+5 -TR- PRIMIERA® Coop 42*				●
+7 ROYAL BRAEBURN*				●
+7 -TR- BRINA*				●
+8 GOLD CHIEF® Gold Pink*				●
+8 -TR- GOLDEN ORANGE*				●
+10 -TR- FLORINA				●
+12 SWEET STONE*				●
+15 ANNURCA ROSSA DEL SUD				●
+15 ANNURCA BELLA DEL SUD				●
+15 GRANNY SMITH				●
+15 NEIPLING EARLY STAYMAN				●
+15 SUPERSTAYMAN				●
+15 -TR- BAUWADE				●
+20 ZHEN® Aztec*				●
+20 KIKU® Fubrax*				●
+25 IMPERATORE (MORGENDUFT)				●
+25 IMPERATORE DALLAGO				●
+30 -TR- GOLD RUSH® Coop 38*				●
+35 SIMIRENKO				●

# Apple Orchard

## Training systems and orchard spacing

training system	tree spacing (m)	trees/ha
slender spindle (hills, mountains)	3-3,2 * 0,8-1,2	2600-4160
slender spindle (plains, valley)	3,5-3,7 * 0,9-1,3	2080-3180
solaxe	4-4,5*1,2-1,5	1480-2080
V	3,5*0,7-0,8	3500-4000
super spindle	3-3,2*0,5	5700
trellised-Y	3,5*1	2860
candelabra	3,5*1,5-2	1400-1900

Vigour of apple rootstocks



# Apple Orchard

## The Problem: What System to Plant?

- There is great disparity of opinion on the optimum planting density.
- Some growers plant 500-750 trees/ha on semi-dwarfing rootstocks with Central Leader.
- Most growers plant 1250-2500 trees/acre on dwarfing rootstocks with some version of Vertical Axis.
- A few growers plant 5000 trees/acre on dwarfing rootstocks with Super Spindle.

# Apple Orchard

## Viable Orchard Systems

System	Trees/acre	Trees/ha	Spacing (ft.)	Rootstocks
Slender Pyramid	340	840	8' x 16'	M.26, G.30,G.935
Vertical Axis	622	1538	5' x 14'	M.9, G.41,G.11
Slender Axis	908	2244	4' x 12'	M.9, G.41,G.11
Tall Spindle	1320	3262	3' x 11'	M.9, G.41,G.11
Super Spindle	2178	5382	2' x 10'	M.9, G.41,G.11

# Apple Orchard

Slender Spindle/M.9



# Apple Orchard

Triple Row Slender Spindle/M.9





# Apple Orchard

Geneva Y-trellis/M.26



# Apple Orchard

V-Slender Spindle/M.9



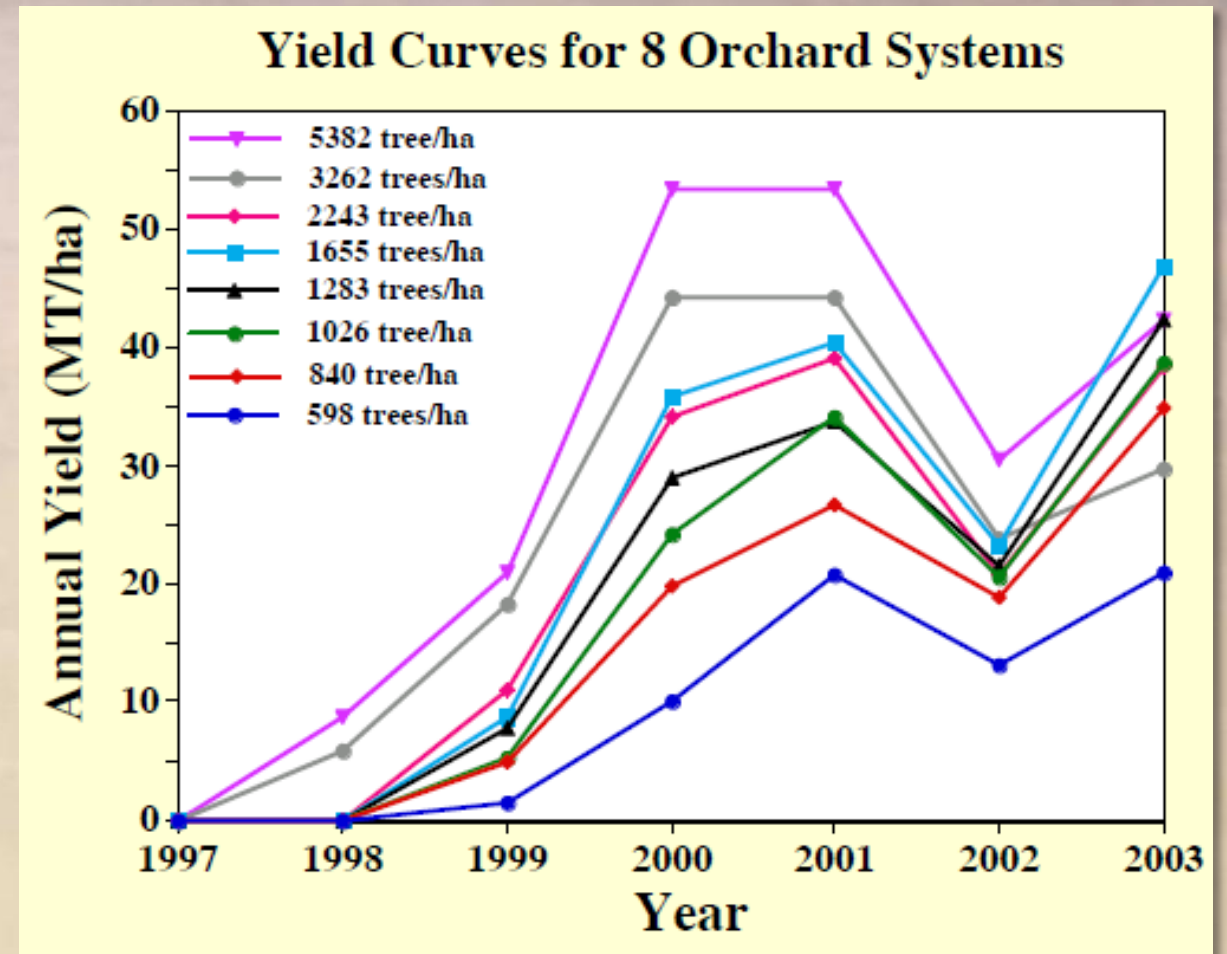
# Apple Orchard

Tall Spindle/M.9



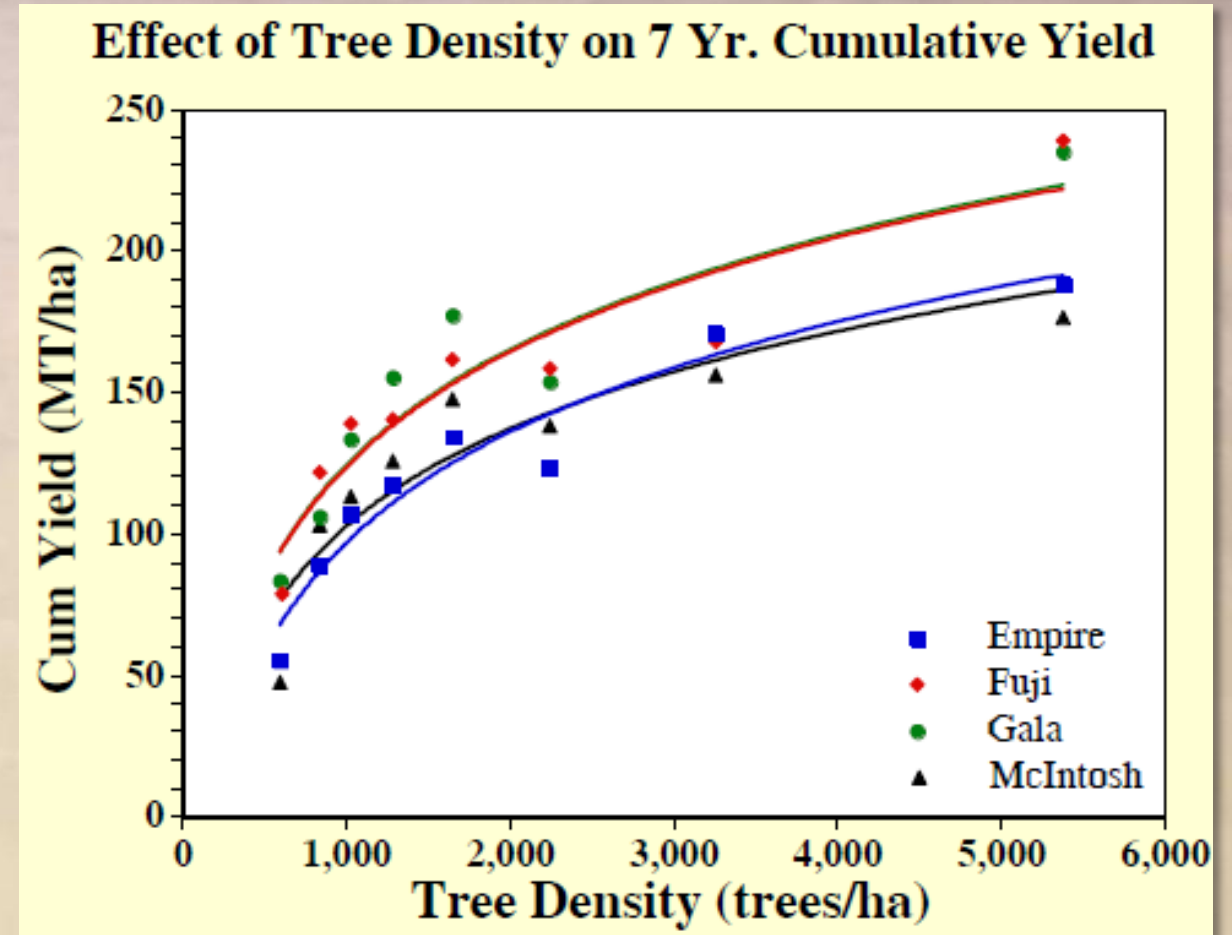
# Apple Orchard

- Tree density had a highly significant effect on yield per ha.
- The highest density system achieved 50Mt/ha on the 4th year while the lowest density system did not surpass 25 Mt/ha.



# Apple Orchard

- Tree density had a highly significant negative effect on cumulative yield per tree but a highly significant positive effect on yield per ha.
- The cumulative yield per ha of the highest tree density was 3X greater than the lowest density



# Apple Orchard

## Early Cropping

Cropping must begin:

- In the second year with the Tall Spindle system.
- Cropping targets for the Tall Spindle:
  - Year 1 1-5 fruits
  - Year 2 20 fruits
  - Year 3 40 fruits
  - Year 4 70 fruits
  - Year 5 90 fruits



# Apple Orchard

## Pruning Year 3- 5

- Allow crop to bend the top.
- Limit height of tree only after top has bent by cutting leader to a weak fruitful side branch.
- Remove branches larger than 3/4 inch diameter.
- Remember "large branches create large trees"
- Shorten older, pendant branches to a weak side branch or spur.
- With Gala begin stubbing back pruning.



# Apple Orchard

## Pruning Years 6-20

- Limit height of tree by cutting to a fruitful side branch.
- Annually remove 2 branches per year ( limb renewal pruning).
  - Focus on the middle tiers of branches first then on upper branches.
- Remove low hanging branches.
- Shorten pendant branches to point of bend.
- Do not over prune.



# Apple Orchard

Pruning Years 6-20



# Apple Orchard

## Young Tall Spindle Orchard



# Apple Orchard

## Older Tall Spindle



# Apple Orchard

## Conclusions

- 1) The tall spindle or Slender Axis systems appear to be the most profitable systems.
- 2) High tree density gives high early yield.
- 3) Highly feathered trees are the key to the systems.
- 4) Minimal pruning at planting (No heading the leader or tipping the feathers at planting)
- 5) Branch angle management. Bending feathers below horizontal at planting induces early cropping and limits branch size.
- 6) Branch caliper management. Ruthless removal of large branches keeps trees manageable. "Large branches create large trees"



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**in the field and beyond**