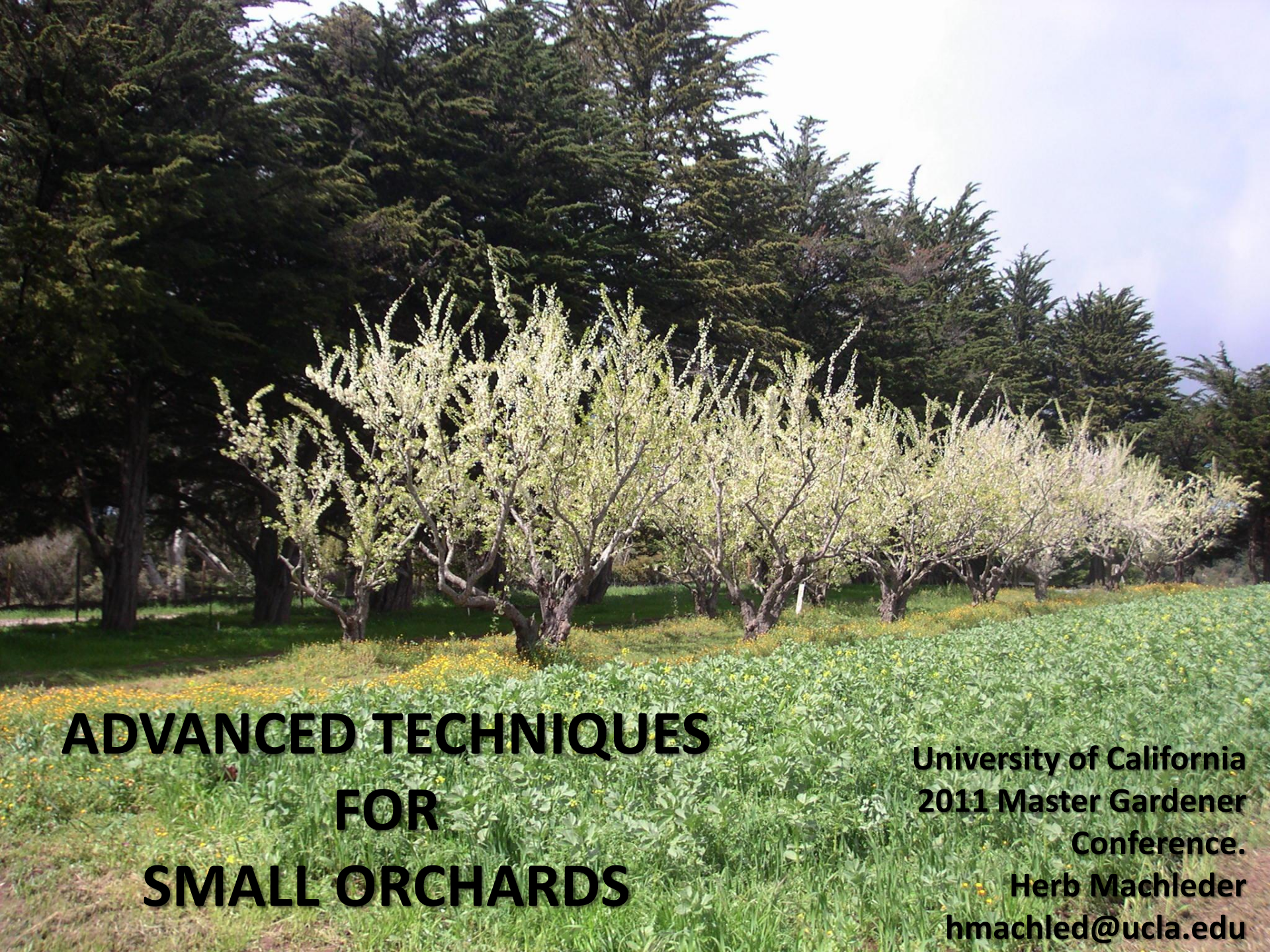


ADVANCED TECHNIQUES FOR SMALL ORCHARDS

University of California
2011 Master Gardener Conference.
Herb Machleder
hmachled@ucla.edu

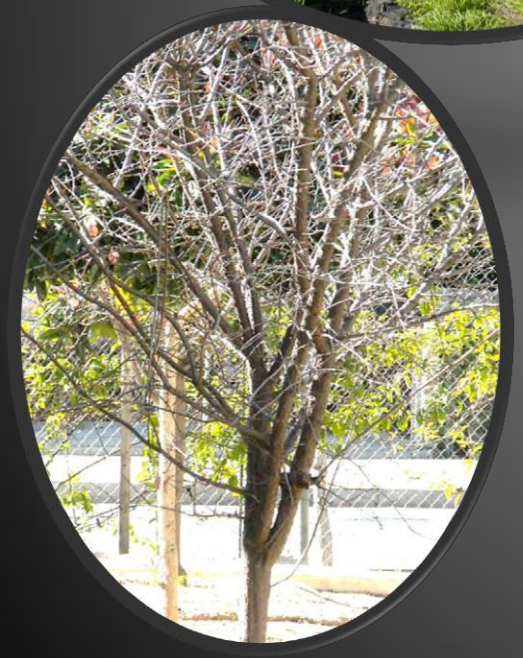
Importance of tree structure for a healthy and productive orchard:

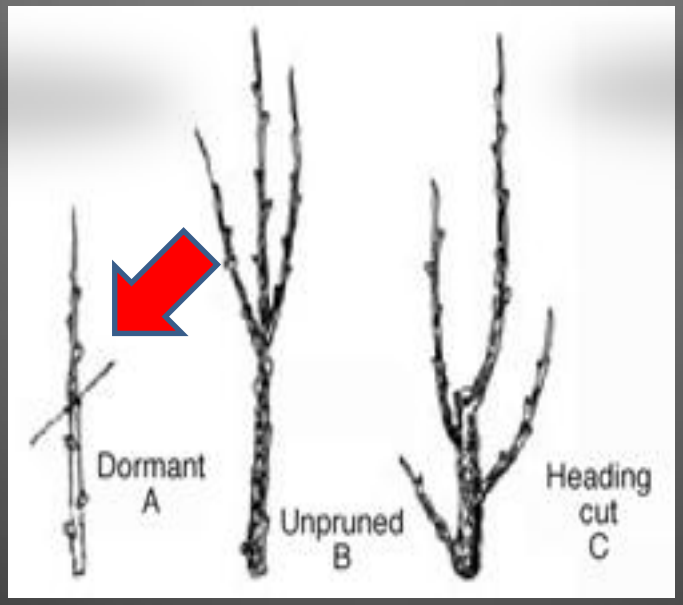
1. **Why change the nature of the tree from native ecology to the orchard?**
   a. *Results of the Natural Selection process*
   b. *Use of grafted rootstock*
2. **Training and Pruning as complimentary techniques**
   a. ***The Tools***
      i. Training: Spreading, Staking, Weighting, Notching
      ii. Pruning: Bypass pruners, Anvil pruners, Girdling knife
   b. ***The Techniques***
      i. Basic tree configurations: Central Leader, Open Center, Variations
      ii. The standard pruning cuts: Heading, Thinning, Stopping, Renewal
      iii. Recognizing Fruiting from Vegetative; wood, shoots, and buds
3. **Small Area Orchard Strategies, and special techniques**
   a. *Special configurations (Dwarfing rootstocks and Genetic Dwarfs)*
      i. Espaliers and Trellis, Multiple Grafted Trees
      ii. “Four in a hole,” Fruit Bush, Container grown trees

The most important step in the orchard, is the one most often missed in the Small Orchard

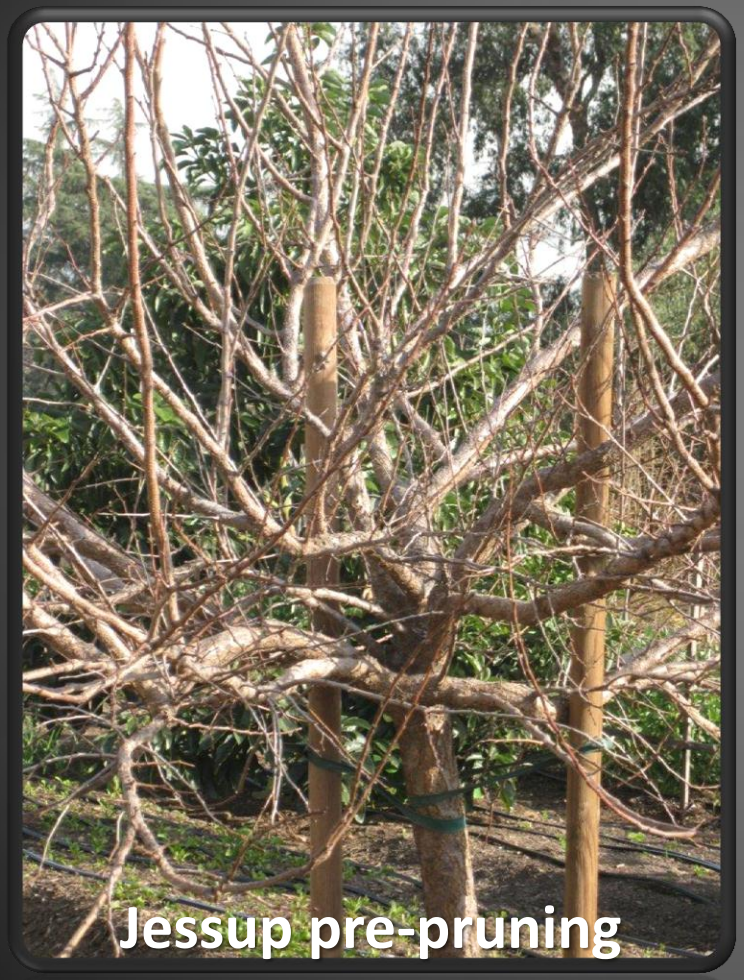
From the Nursery

CUT HERE !





No regular pruning: broken branches, declining production, small damaged fruit, problems with disease

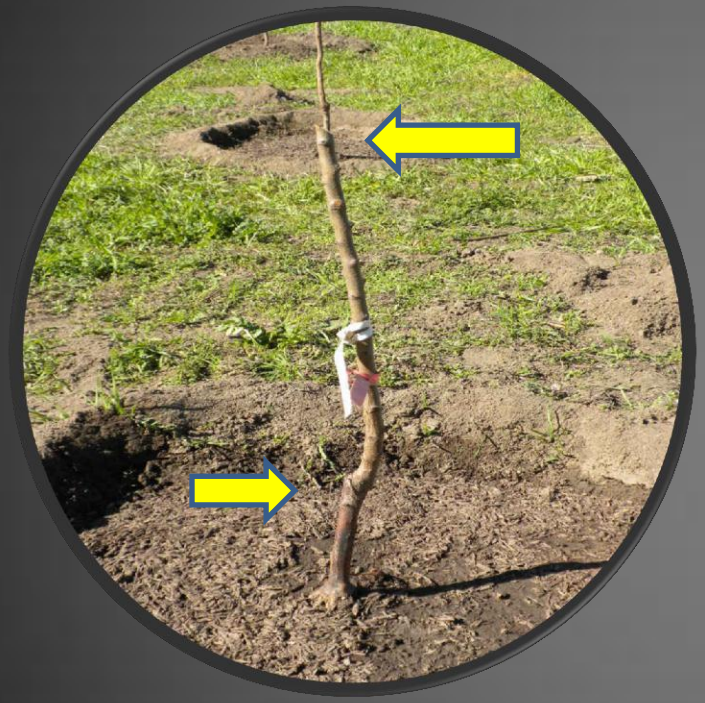


Jessup pre-pruning

Jessup post-pruning

Plant with graft above the ground…..
THEN PRUNE TO A KNEE-HIGH WHIP ! !

At Most !



The best way to maintain controlled height is to start the scaffold branches at 12” to 36” depending on training method

Heading cut stimulates branching

Standard **Training** Devices Used in Small Orchards

Spreaders

Weights

Small Organic Orchards Make their own weights

Pruning

Tools for Small Orchards

Some Often Neglected Pruner Fundamentals I

Turpentine “like dissolves like”

Some often neglected Pruner Fundamentals II

Maintain the Bevel

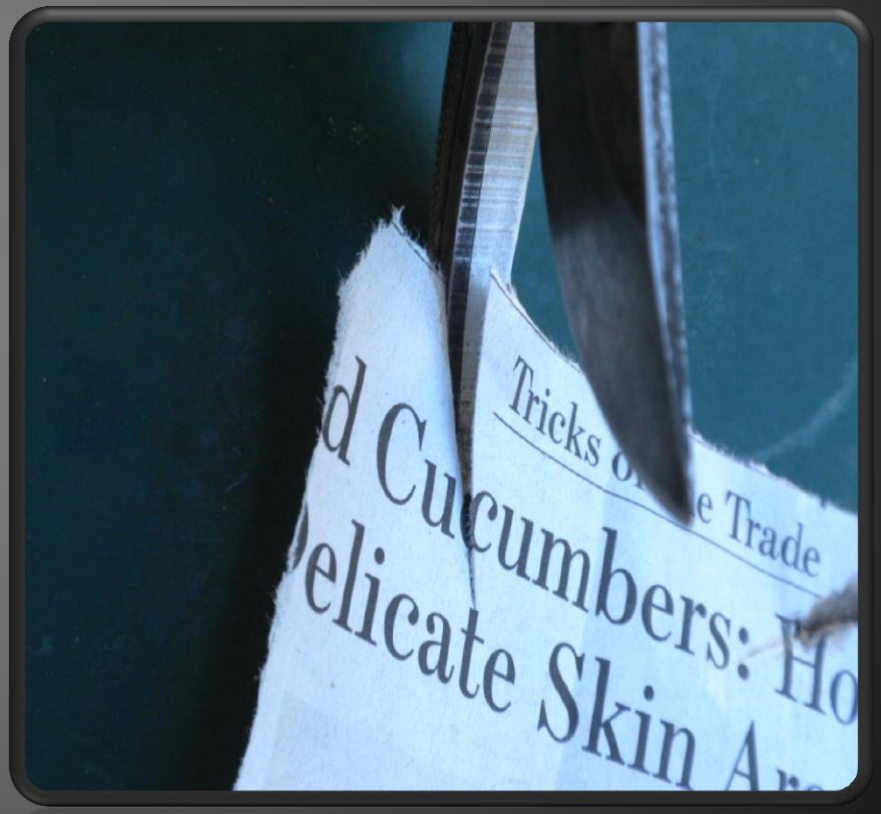
Felcos or Coronas 23°

Remove the Burr

Absolutely Flat !

The Sharper the Cut the Better the Healing

One sheet – clean cut - Pruners ready



Some occasionally neglected fundamentals III

The Anvil Pruners

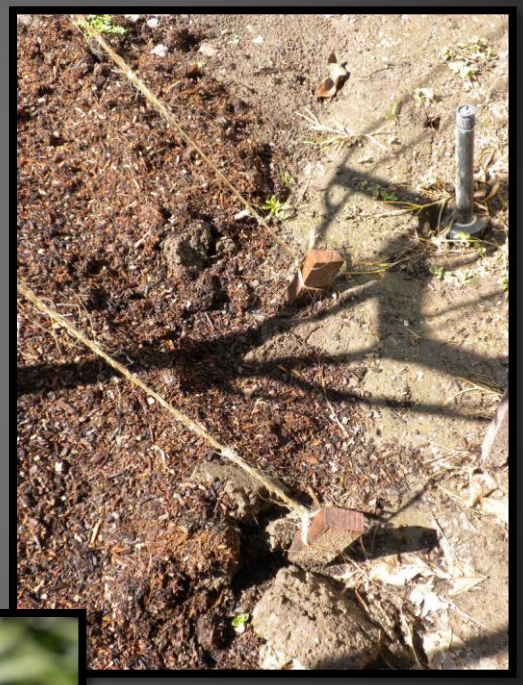
Blade has two Bevels

Anvil Pruners are ideal for pruning dead – dry shoots and twigs. (*Citrus interior)*

**** Anvil pruners have more mechanical advantage, but also crush the shoot tissue.***

Staking, Spreading and Weighting

Training young trees in a small commercial orchard



Strong Apical Dominance in Pome Fruit requires spreading and weighting

Training techniques IV

NOTCHING – “Forcing a Bud”

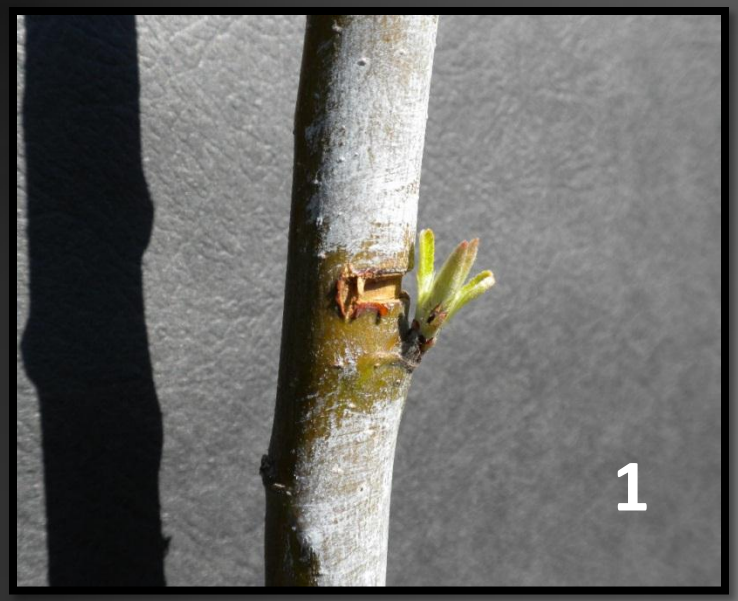
Girdling knife

Empty space – missing branch

“A tree should fill its allotted space.” A major objective of orchard management and tree training.

Training technique V

“Forcing a Bud”



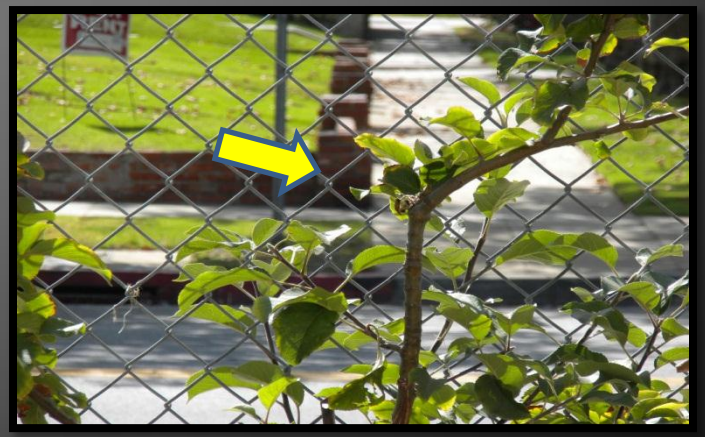
Bud sprouts shortly
after notching

Spreading the new scaffold

5 weeks – Notch healed – Shoot well developed

Training techniques VI

Notching supplies a well placed scaffold limb
Lowest Tier now has 4 quadrant limbs

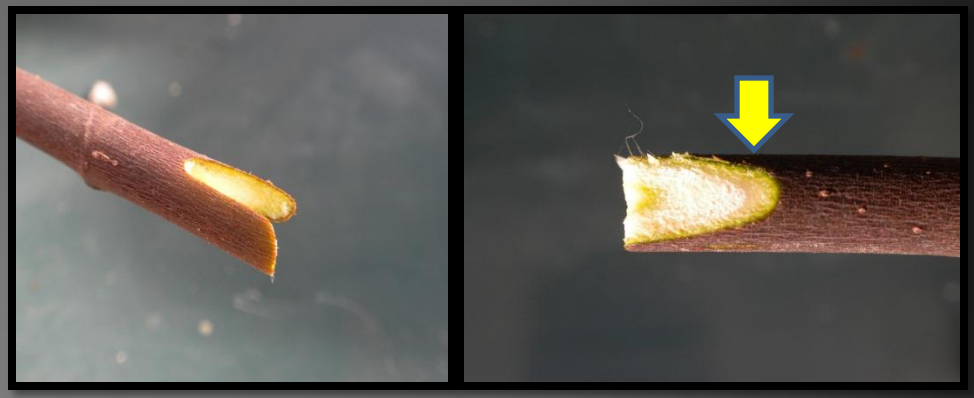


Use notching for new espalier cordon

GRAFTING: It's use in the Small Orchard .

The configuration can vary but the 5 principles must be observed !

- 1- Root Stock and Scion must be compatible
- 2- Cambium of R.S. and Scion must contact !
- 3- Both must be at the proper physiologic stage
- 4- Prevent desiccation
- 5- Provide aftercare
- Hartmann and Kester "*Plant propagation.*"



Grafting: as a training technique

Saddle graft

Inserting a pollinating branch improves yield in self sterile or weak pollinating varieties. Particularly useful in the small orchard.

4 weeks later

Grafting: as a Training Technique

Grafting and Budding Tools

T-Budding

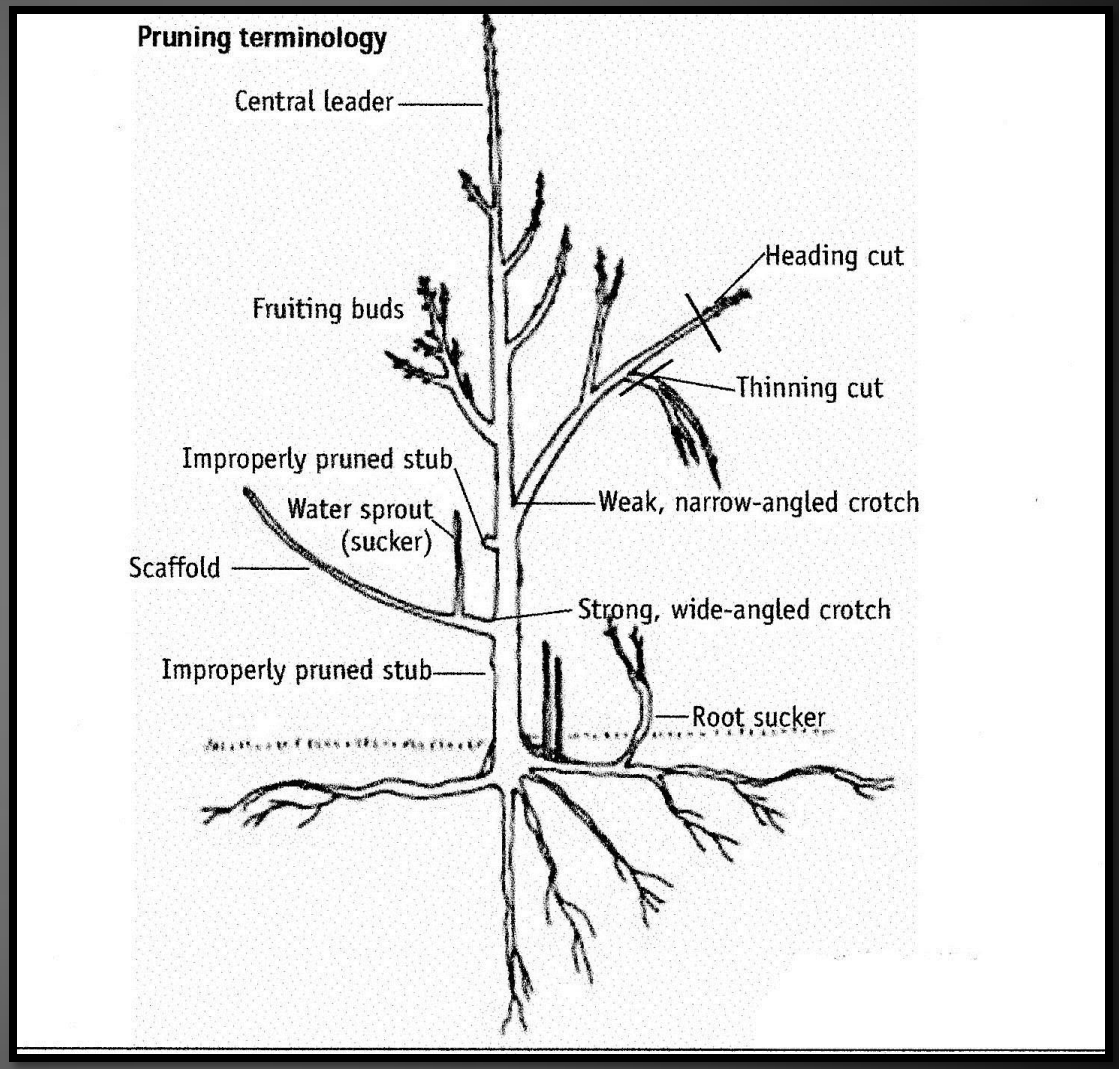
Chip-Budding

Pruning techniques I

The Standard Pruning Cuts

- 1- Heading
- 2- Thinning
- 3- Stopping
- 4- Renewal

- A- Initial Pruning
- B- Maintenance
- C- Balance fruiting and vegetative wood



Apples, pears, cherries, plums bear best on 2-3yr old wood, peaches on last yrs wood. Productivity depends on proper pruning. Horizontal = fruit spurs, vertical = vegetative

Pruning Techniques II

Heading Cuts

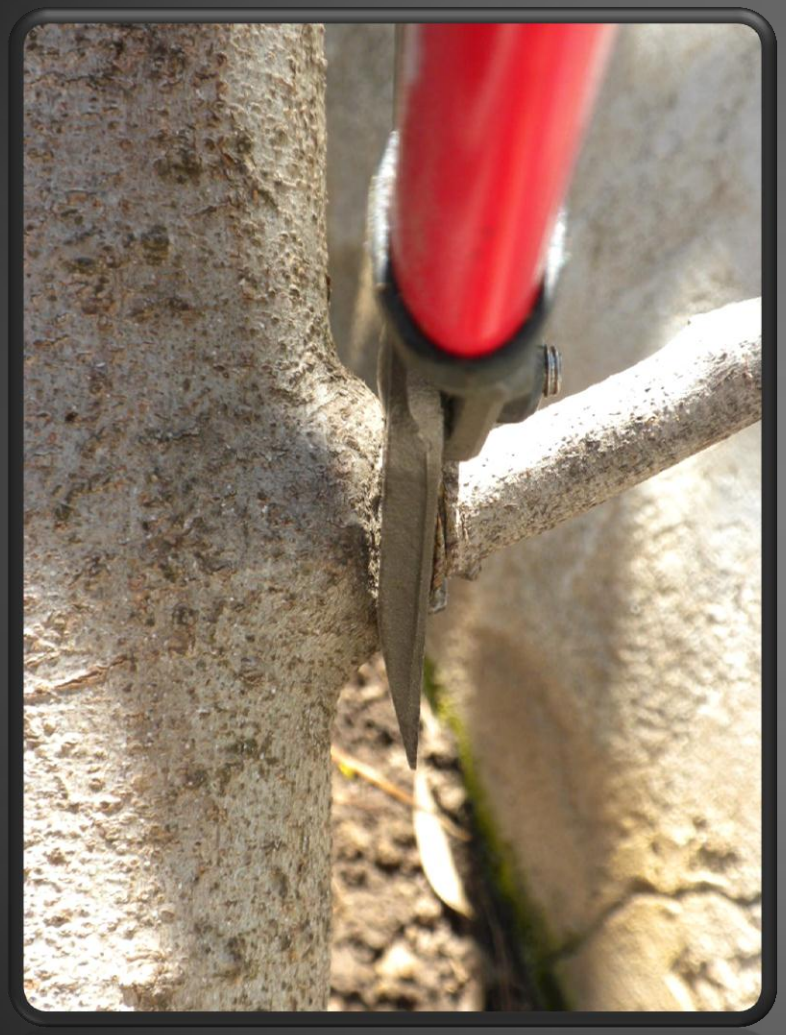
1st year - 2nd year - 3rd year

Top 3-4 buds freed from Auxin suppression.

Pruning Techniques III

Thinning Cuts

To remove a branch or shoot with no regrowth



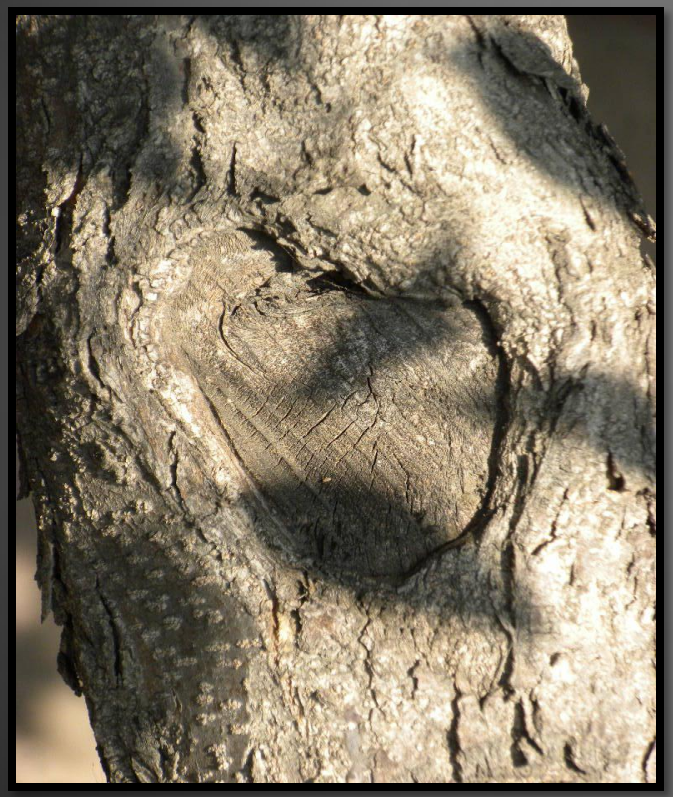
Avoid *flush cuts*, preserve the *branch bark-collar*

The <u>two-step</u> and <u>three-step</u> Thinning Cut

Prevent the *trunk bark tear* at lower end of cut

Pruning Techniques V

a – Consequence of a flush cut
b – Preservation of the Branch Bark-Collar



a

b

Stumps will not heal over.
True for both Heading and Thinning cuts

Stump is sequestered

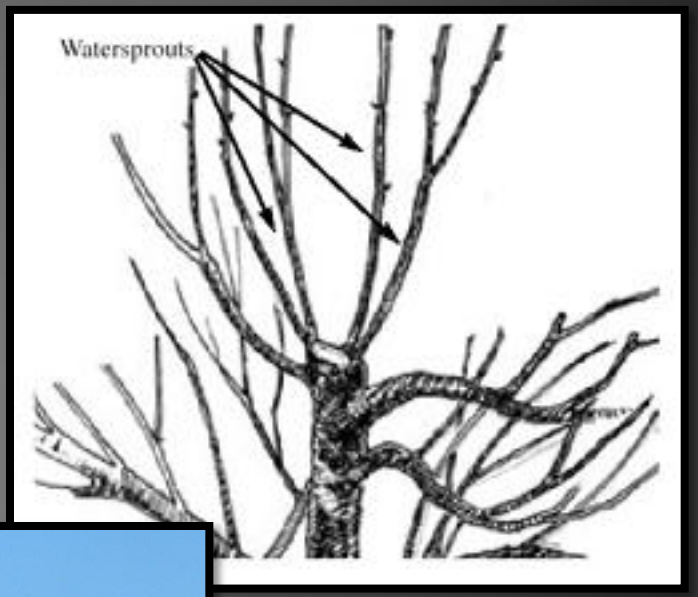
Heading cuts ¼” from bud. Thinning cuts at branch collar

Pruning Techniques VII

Stopping Cut

Into 2yr old wood near weak lateral. When tree has "filled it's space."

Renewal Cut



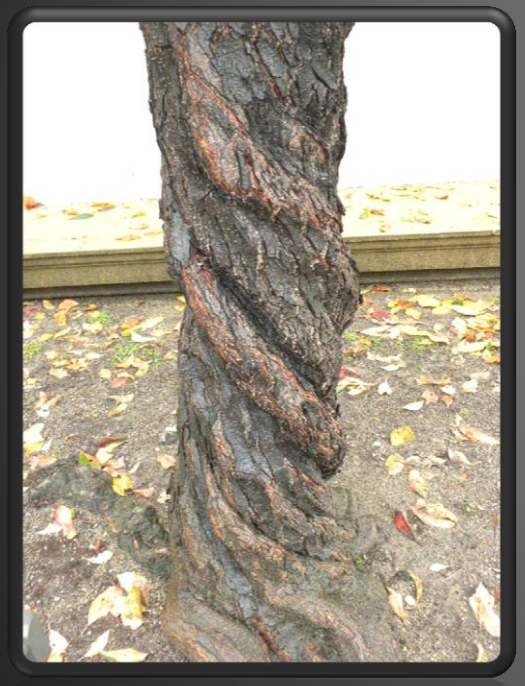
Into > 4 yr old Wood. Two shoots are then chosen, and trained for a new scaffold branch

Some Standard Training Systems

1- Open Center

2- Central Leader

3- Special Systems



4 plums Pleached
Herculaneum 23
August 79 A.D.

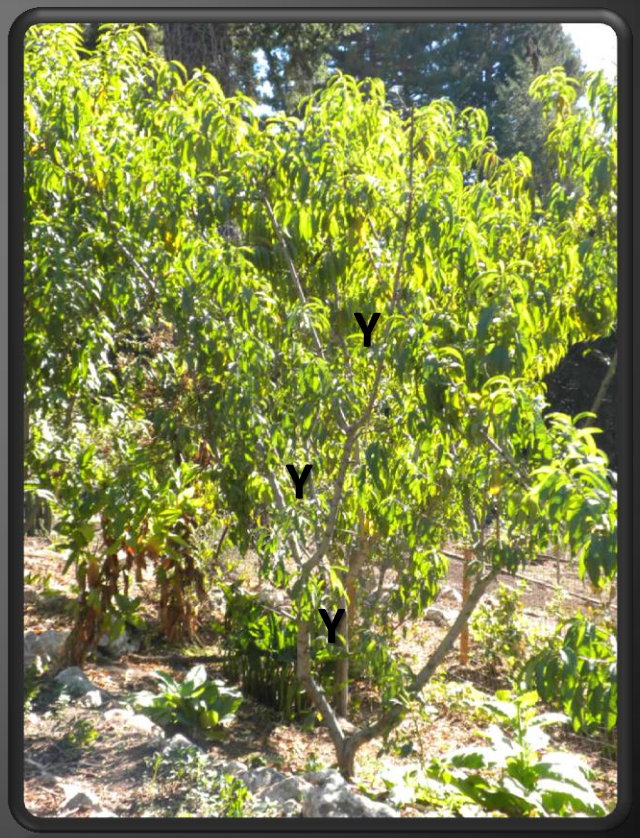
Perpendicular "V"
Espalier – Trellis
Multiple grafted
Fruit Bush, "4 in a hole"
Container "edible ornamentals" etc.

The Open-Center configuration for Stone Fruit

All branches receive good sunlight for flower bud formation

Training III OC

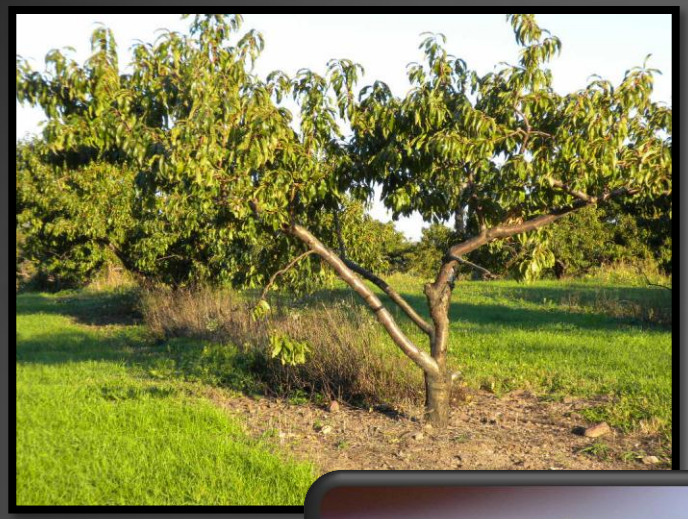
Pruning and spreading a one year old Plum tree

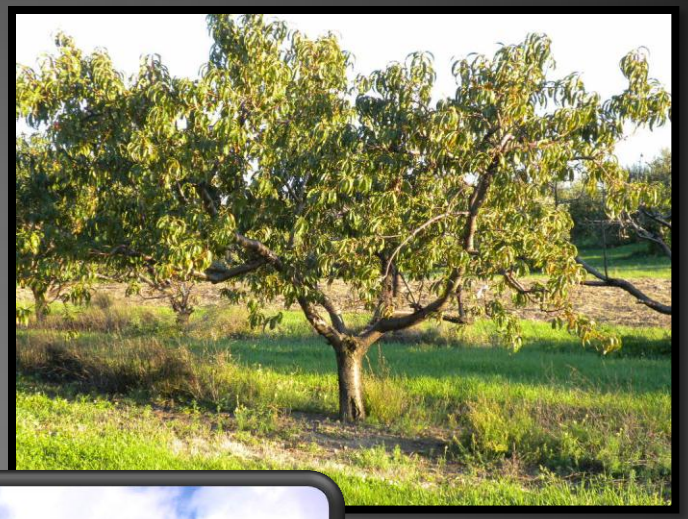


The ultimate form of the Open-Center tree Is a *series of "Y"s* to fill the available space. Capturing light is one of the 1° objectives of orchard training.

Training IV OC

Open-center Peach trees





Older open-center tree Dormant period

Typical sequence in a small orchard

50% reduction of last years shoots, then shortened 30%

…Sequence II

Vigorous pruning leaves plenty of fruiting wood

Good fruit set

March

…Sequence III

1st pass

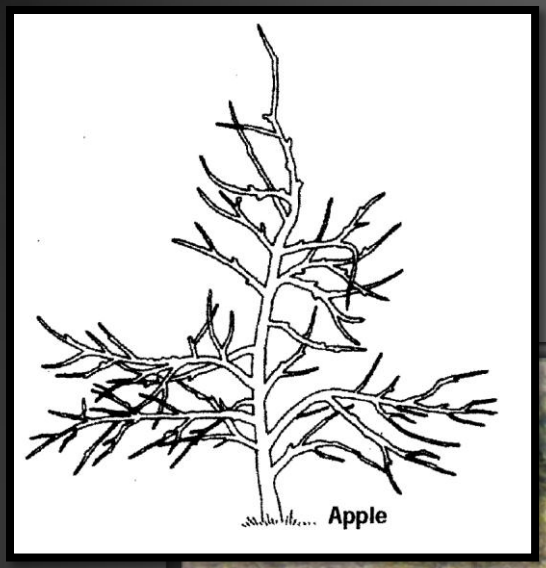
“Thinning”
A most important orchard practice

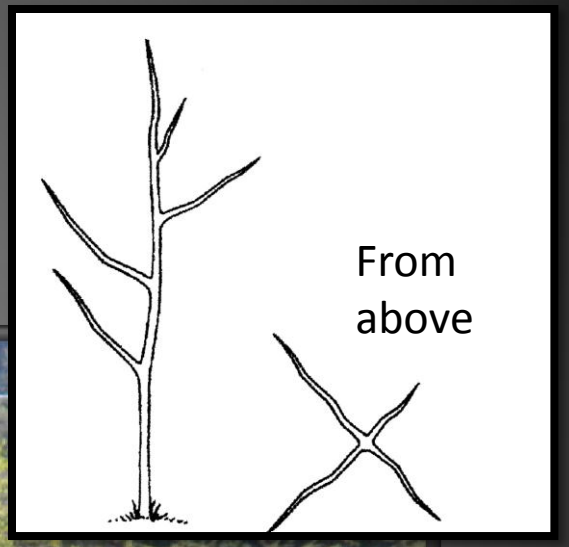
Thinning avoids *alternate bearing*

the earlier the better

Training V MCL

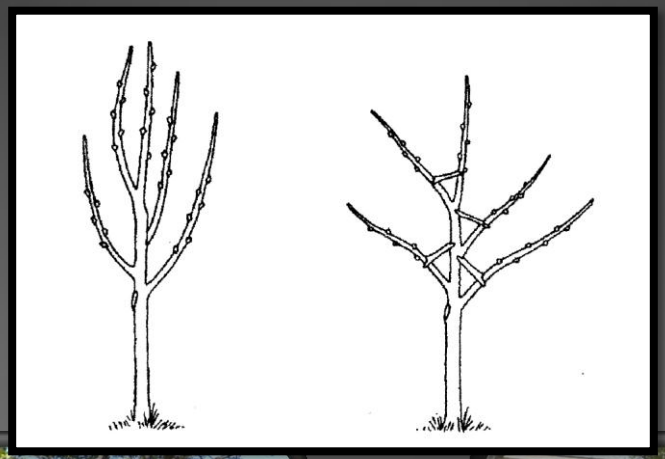
Modified Central Leader
Pears, Apples



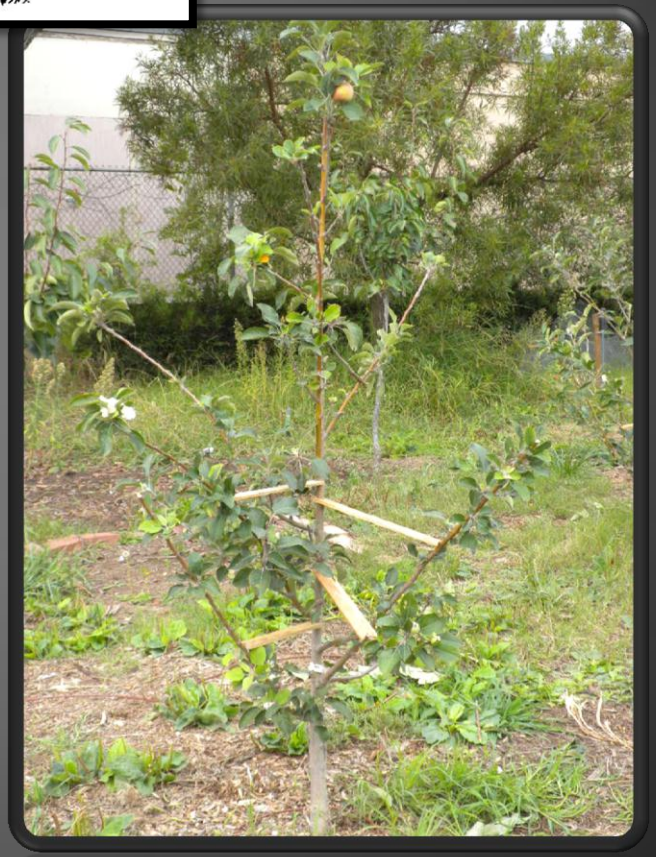


Mature, small farm apple orchard

Training VI MCL

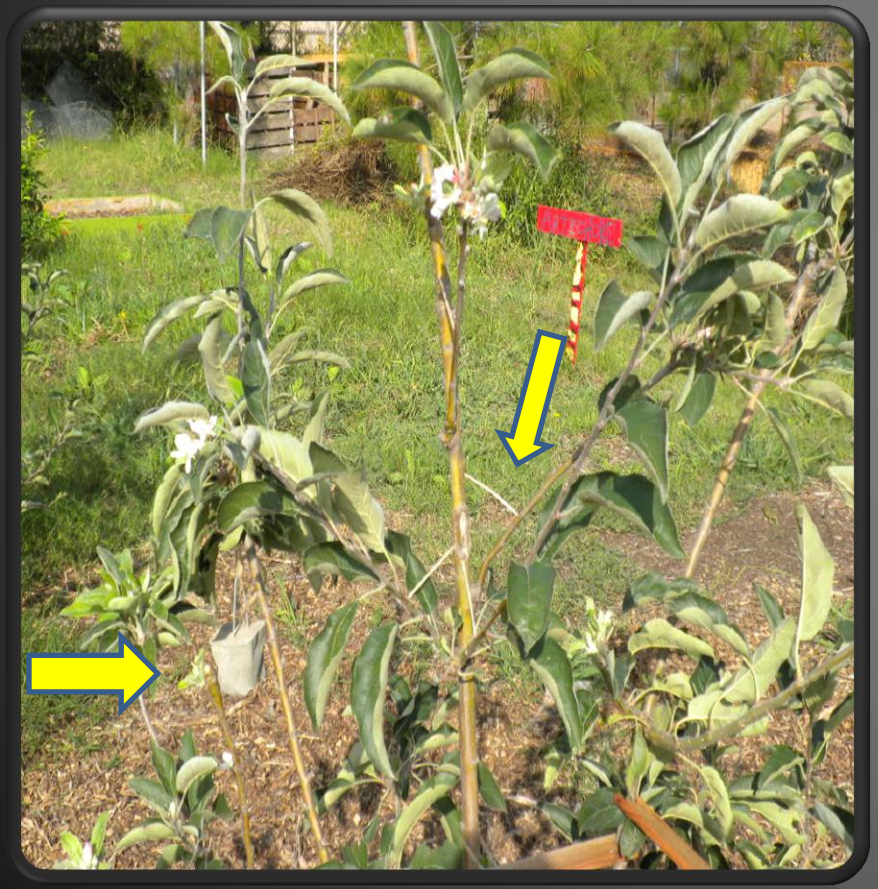


To develop fruiting buds, compact upright growing trees must be spread (45-60°)

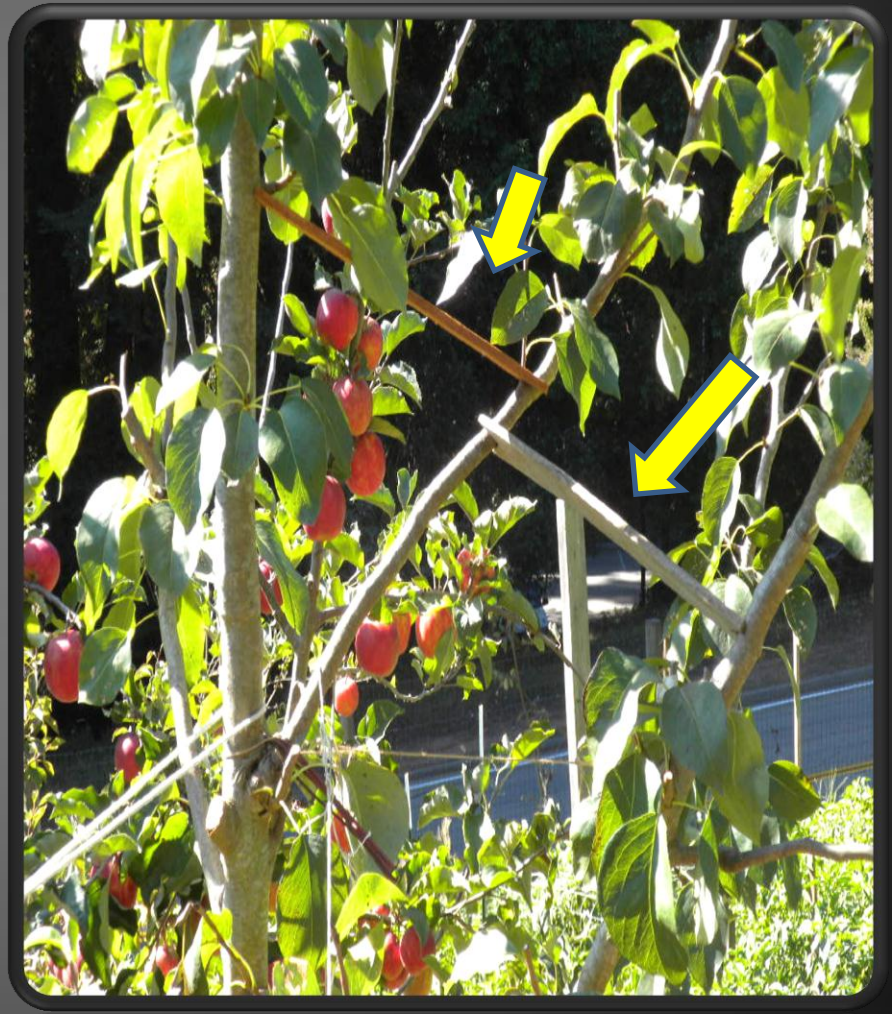


Training early shoots to form tiers in a young Apple Tree

Tooth Pick method



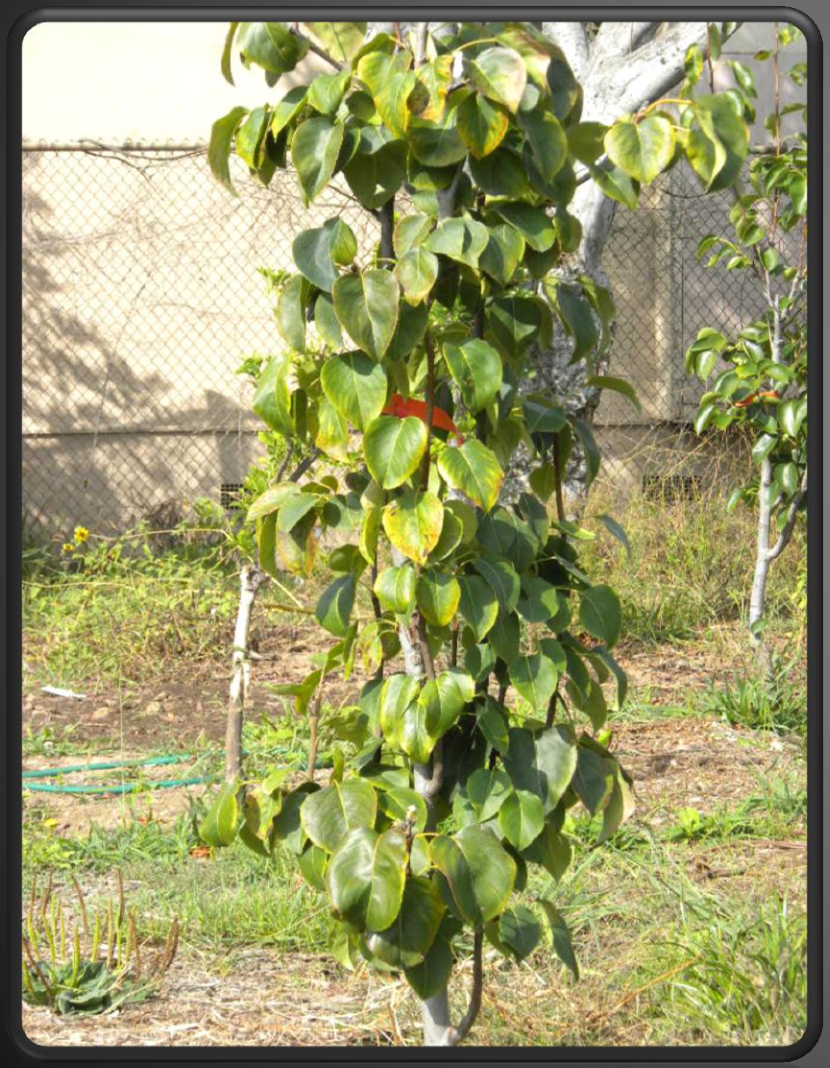
Training continues as the tree progresses until this Apple fills it's allotted space



Training IX MCL

Using Spreaders to train a young Pear tree

Typical strong Apical Dominance



Training X MCL

Dormant Apple and Pear
Mature Modified Central Leader

This structure should yield a good fruit set

next

Training XI

Espalier and Trellis Training Systems

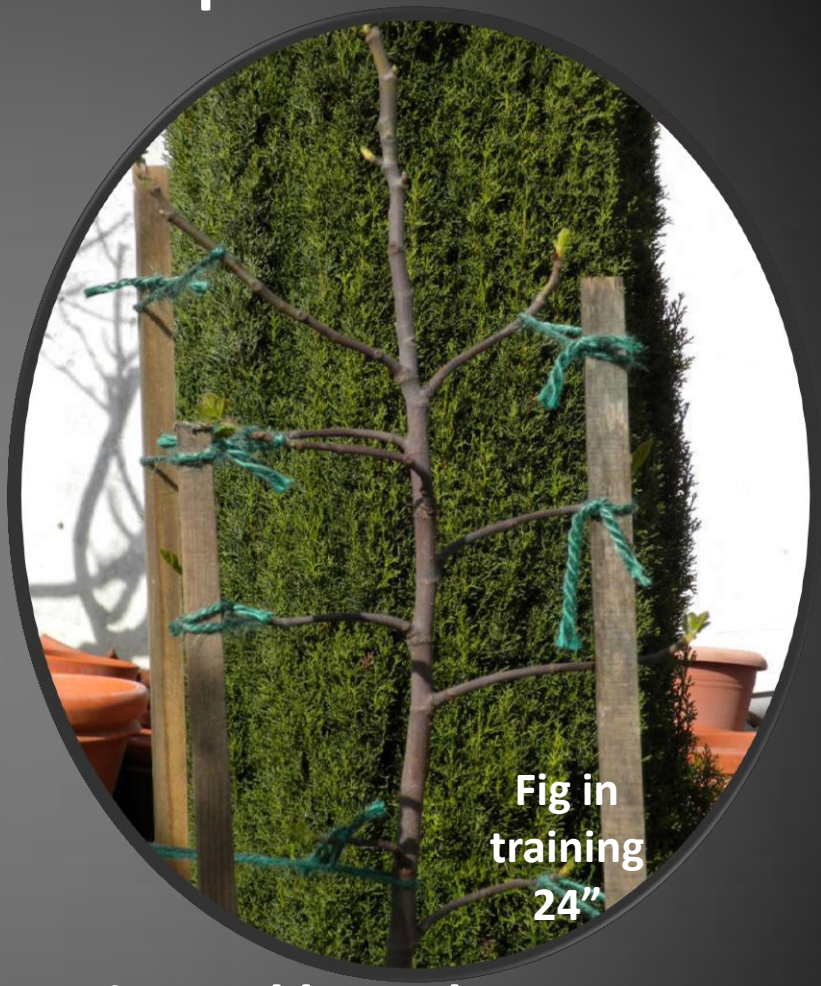
Horizontal = lots of fruiting spurs

Fragrant blossoms cover a fence

Training XII

compact with good fruit production

Espalier and Trellis



Horizontal branches set more fruit buds and suppress vegetative growth

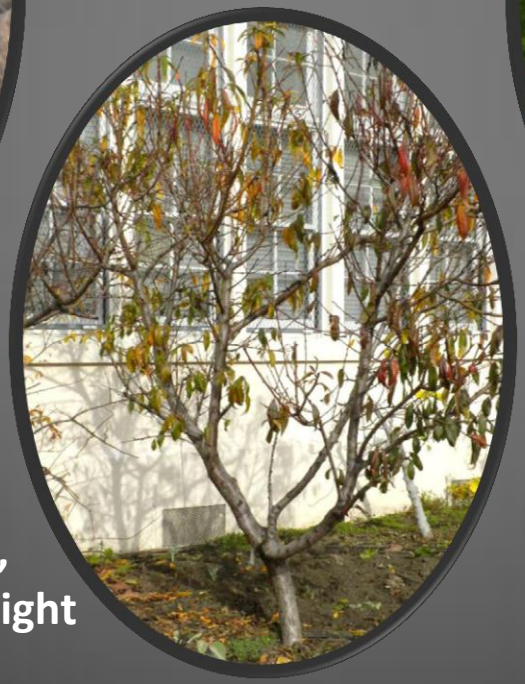
Espalier/Trellis

an excellent high-density strategy

Training XIII

Special Training for the Multiple Grafted Tree

Each graft lives in its own quadrant



Mid Pride, Red Baron, Double Delight PEACH

Anna, Fuji, Gordon, Dorset Golden

Pruning for balanced growth is critical

Multiple grafted trees should be pruned with an open center

Some special techniques used by small space planters

There is experiential and anecdotal evidence, but not wide experience !

The Fruit Bush

- **Can be used with Apple and Pear (Asian), Fejoa etc.**
- **More difficult with Peach, Nectarine, Apricot.**
- **Pruning maintenance is arduous. 3 to 4 times per year is essential to maintain fruiting/structure**
- **Timing is demanding.**

"Four in a hole, etc"

- **Potentially successful with very careful selection and technique.**
- **Suggest similar pruning strategy to multiple grafted trees.**
- **All of the previous management methods need to be observed**

Very successful at the UC Fair Oaks Horticultural Center (Ed Laivo, Chuck Engels)
See UC Video

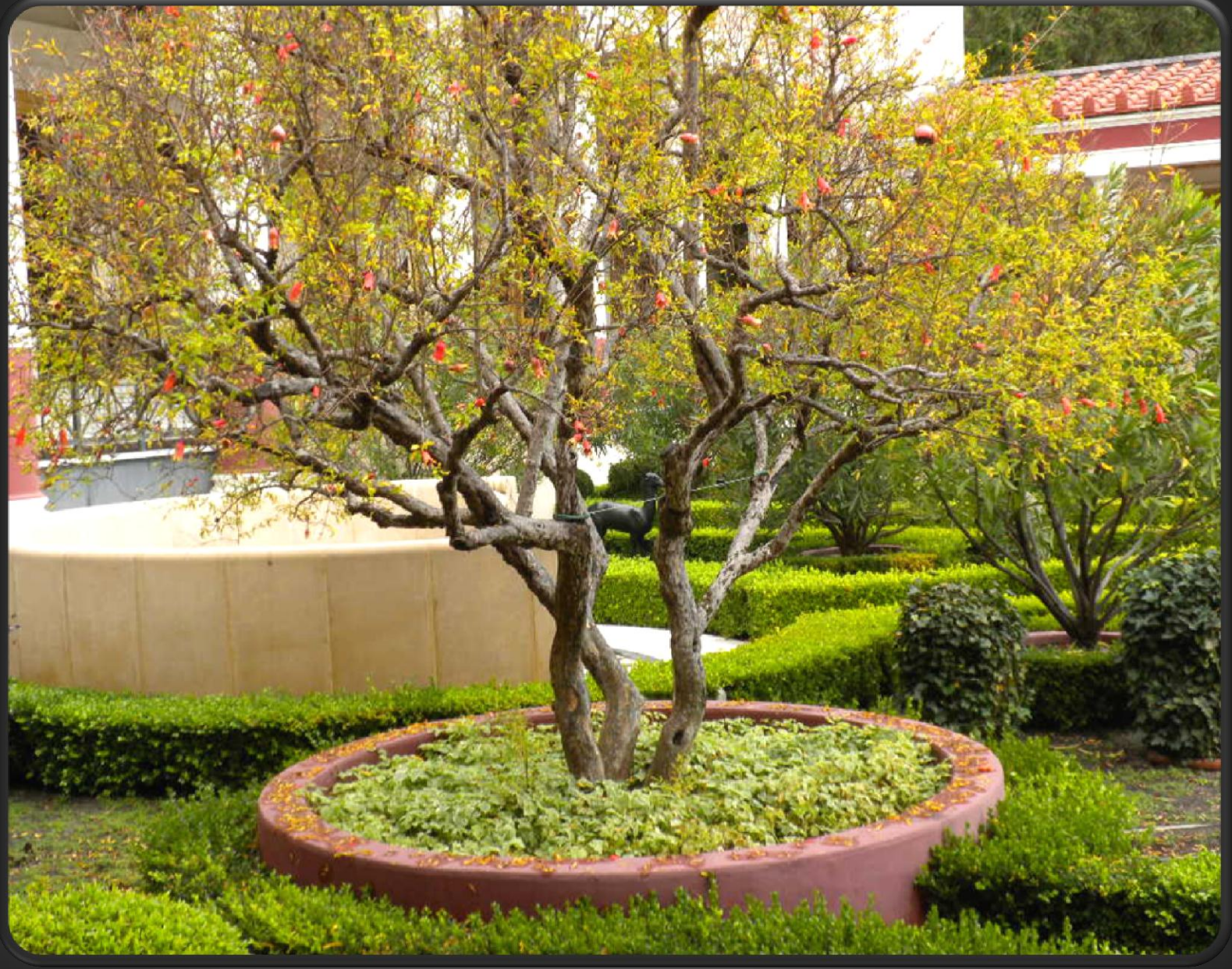
Container grown fruit trees *

A long and successful history with Citrus, now attempted with deciduous fruit trees

- Genetic Dwarfs, or dwarfing root-stock
- Scion Selection, Pollination
- Site,Chill Hours, Heat Units
- Container
- Potting mix
- Water Management
- Fertility
- Root Pruning
- “Edible Ornamentals”

* See end notes !

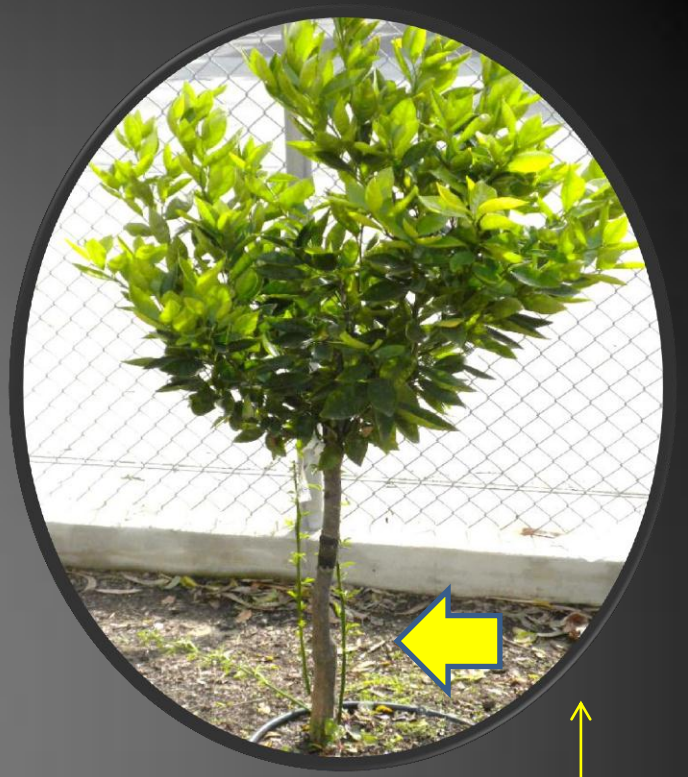
Meyer Lemon 15 yrs in pot



Pomegranate **(Big patio-Big pot)**

Maintenance Pruning I

Suckers



Water Sprouts

From the Trifoliate root-stock

Maintenance Pruning II

Asian
Pear

OH
X
F333

Suckers get out of hand !

Recognizing Fruiting Wood and Fruit Buds from Vegetative Wood and Shoot Buds

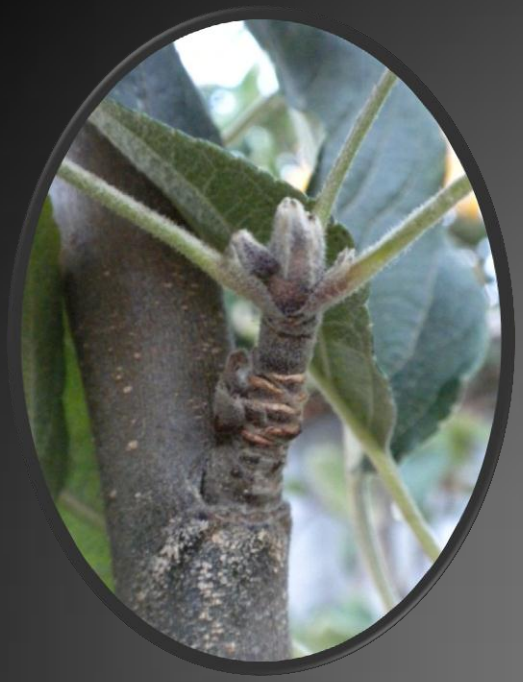
Really important for productive pruning

PEACH

Compound Bud **characteristic of stone fruit.**
Flat vegetative bud **flanked by two** ***rounded flower buds***

This one year old shoot will only produce fruit for the current year

Recognizing Fruiting Wood II



Transition of Apple Spur to Blossom Rosette.
The Spur can produce fruit for ±10 years

Recognizing Fruiting Wood III

Asian Pear

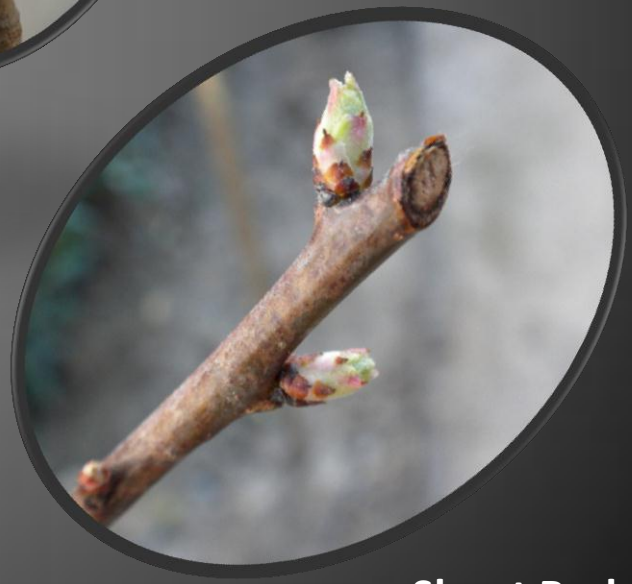
Sets fruit on
Spurs

Fig

Note the
shoot bud,
and the
Breba ***fruit***
bud !

Flower Buds

Apricot



Shoot Buds

and so…….

Some important objectives of pruning and training are:

- To control tree height and fill available space
  - "light on the orchard floor is wasted!"
- Provide strong, open scaffold structure
  - Branch-trunk angles at 45-60° (fruit spurs/growth-shoot balance)
- Ensure good light and air penetration
  - Sunlight = sugar, color, flavor, size. Air flow = < disease resistance
- Balance vegetative and fruiting wood
  - For good yearly crops and adequate new growth
- Renew fruiting wood regularly
  - To maintain fruit production as tree matures
- Seasonal corrective, and maintenance care

One more slide …….

“Disclaimer”

Caution !
If followed, the foregoing recommendations

may result in the necessity for further, more expensive equipment purchases.

THANK YOU ALL

herb

End Notes: The Pruning Scale, A Methodical Pruning Sequence, Some examples of root stock for dwarfing, tried and tested planting mixes for container trees etc.

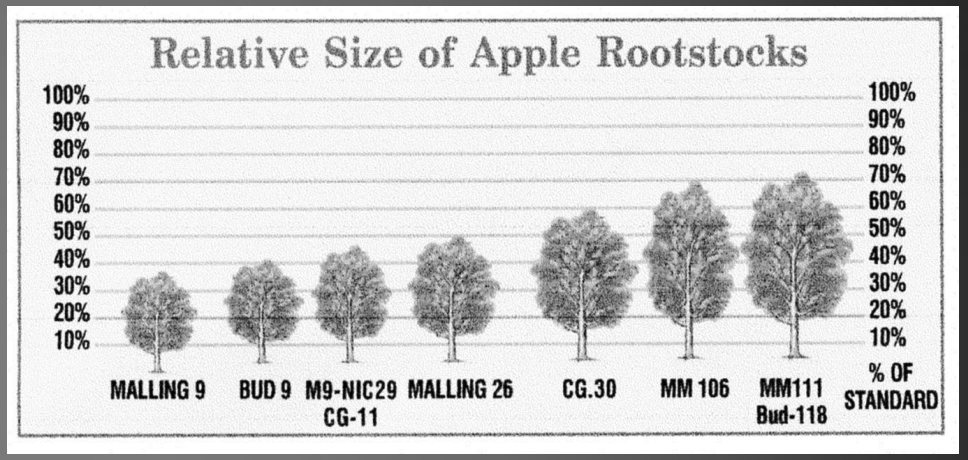
End Notes: (I of IV)

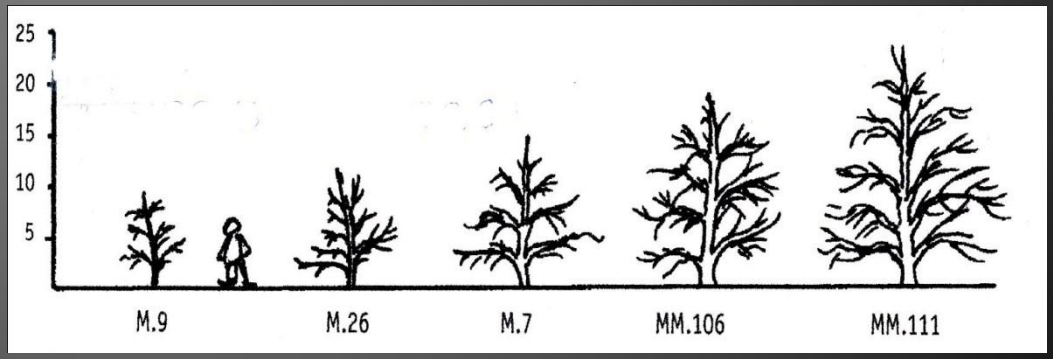
SOIL MIX FOR CONTAINER CITRUS

- 80% ground pine and fir bark 20% fine sand
- To each cubic yard add:
- 2 lbs single super-phosphate
- 3 lbs dolomite lime
- 3 labs calcium carbonate
- 1-1/2 lbs iron sulfate
- 1 lb calcium nitrate
- 1 tsp copper sulfate
- 1 tsp zinc sulfate

Bill Nelson: Pacific Tree Farms

EFFECT OF ROOTSTOCK ON TREE SIZE





Notes: II

THE PRUNING SCALE

10%	Avocado Apples, Pears
20%	Persimmons, Pomegranates Figs
30%	Plums Apricots
40%	Peaches, Nectarines Feijoa
50%	

Approximate GUIDE TO AMOUNT OF 1YR WOOD PRUNED IN DORMANT SEASON

Notes: III

A pruning guide used by the L.A. Urban Orchard Team

PRUNING SEQUENCE

- **A methodical approach for pruning teams**
- **<u>Start with: generic pruning, common to fruit trees (thinning cuts)</u>**

1. **Suckers, Water Sprouts**
2. **Broken shoots or branches, Downward pointing shoots/branches**
3. **Diseases shoots/branches (canker, oozing etc.)**

- **<u>Advance to : Maintenance Pruning</u>**

1. **Rubbing shoots or branches**
2. **Crowded shoots or branches**
3. **Twiggy growth**

- **<u>Progress to:</u>**

1. **Shortening fruiting wood (refer to Pruning Scale)**

- **<u>Finish with:</u>**

1. **Heading cuts to reduce height 8', cut highest shoots to outward pointing bud**
2. **Renewal Cuts and Stopping Cuts**

Notes: IV

Links to some more information on the Web

An example of a method for selecting trees for a specific site:

http://mo.laschools.org/green-spaces/documents/view/funding-resources/reference-documents/How_to_Use_the_Tree_Matrix.pdf

An example of an Instructors Guide for a Tree Pruning and Training Course. Or an expanded explanation of the material presented in this Small Orchard Management discussion.

http://www.carthaycenterschool.org/forms/TrainingPruningWorkShop.pdf

The presentation was designed to address this issue !

Report of the "Small Space Fruit Production" course at the Wolfskill U.C. Davis/ USDA-ARS Experimental Orchards.

- *" While most of the audience were Master Gardeners, it was amazing to see how many were not exactly sure what to do when they get a tree. No wonder the 'EZ-Picks' are so popular !"*

- L.E. Cooke Co.
- Center for Urban Horticulture
- 12 September 2009

- *In transitioning from a Standard Orchard to a High Density Planting, whether on semi-dwarfing, dwarfing, or even a genetic dwarf, the principles of Training and Pruning are the basically the same* ***only more so.*** *If you plan to invest in the change you need to carefully review your procedures.*
- Michigan Agricultural Ext. to Commercial Orchard Conf.