Master Gardener Apple Class – April 11, 2018 – Ann M. Chanon and Joseph C. Scheerens

sanctuarysoil.com

Apples –
Malus X domestica

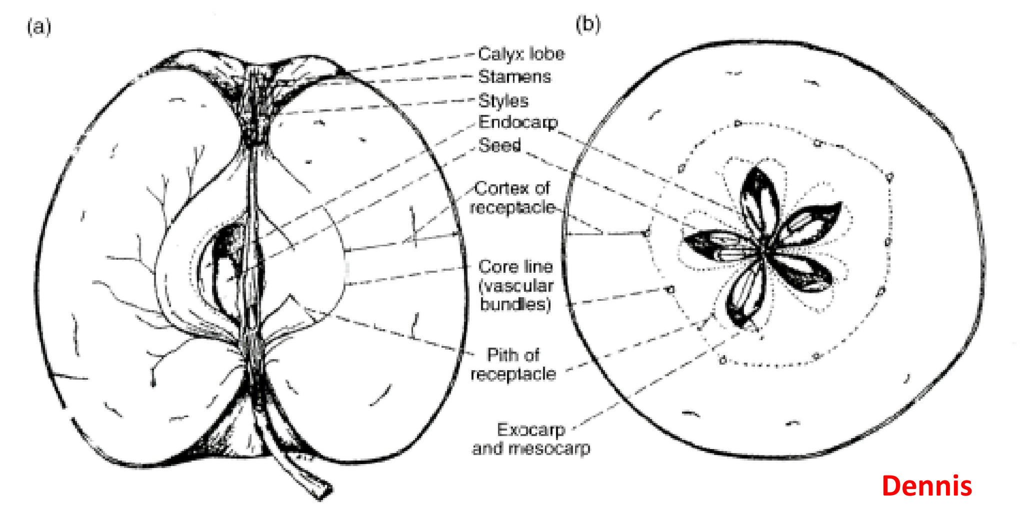


Fig. 7.6. Structure of a mature apple fruit. (a) Vertical section; (b) equatorial section (Robbins, 1933).

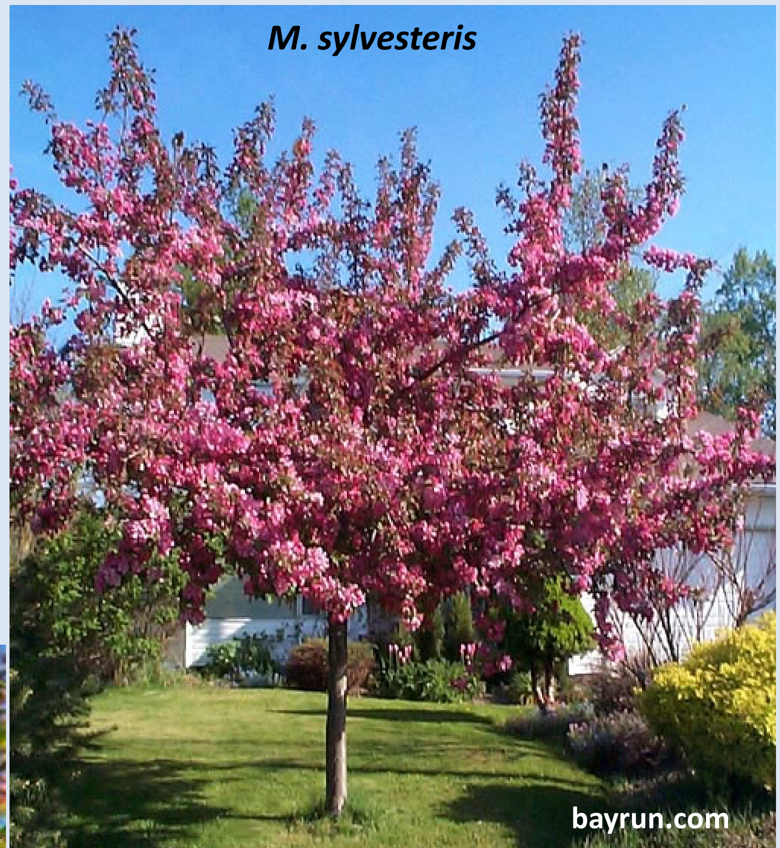
1990's "discovery" – Center of origin of apples in Kazakhstan

"…it is possible to see with our own eyes that we are in the remarkable center of origin of the cultivated apple."
Vavilov, 1931

USDA Germplasm Collections 1989, 1993, 1995, 1996

Malus sieversii

Additional *Malus* species putatively Involved in the formation of *M*. X *domestica*

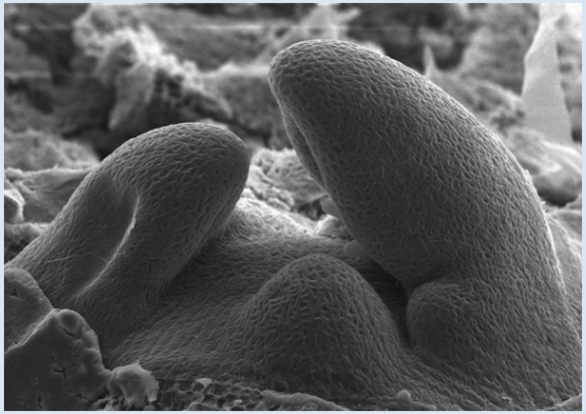


Floral biology, pollination and fruit set of apples

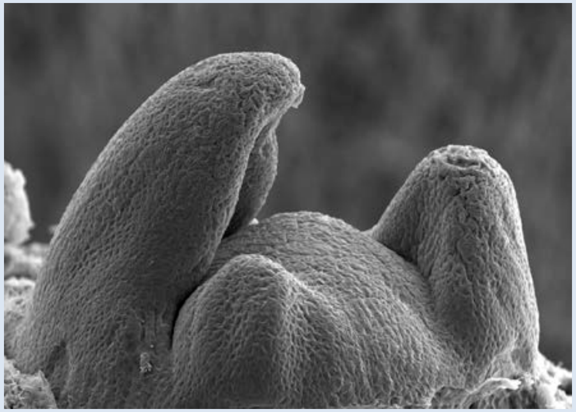

Flowers on spurs
(borne on wood 2 years old or older)

Flowers on shoots
(Borne on wood 1 year old or older)

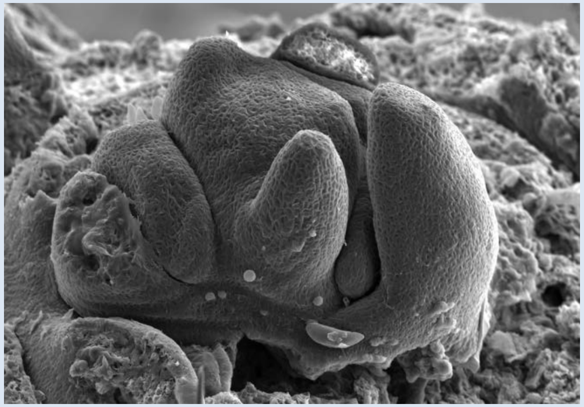
Flower formation in apples



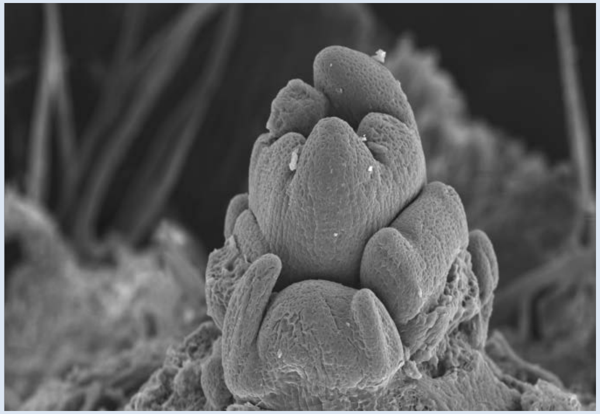
July – Apex is flat
(veg. bud committed)



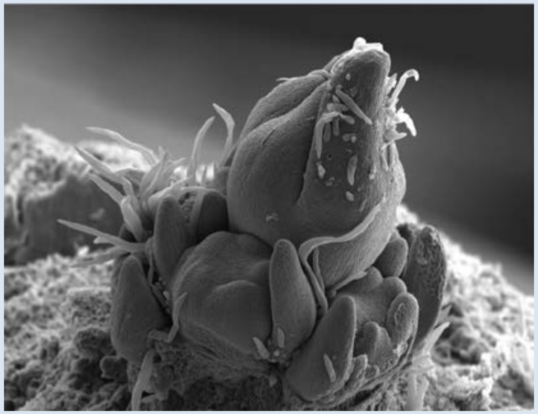
August – Apex is domed



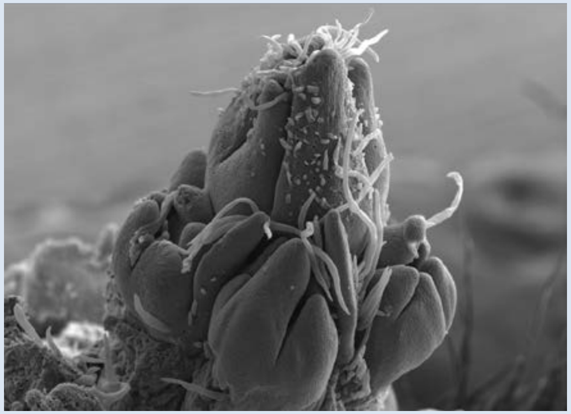
September – Terminal flower initiation



October – Sepals on terminal flower



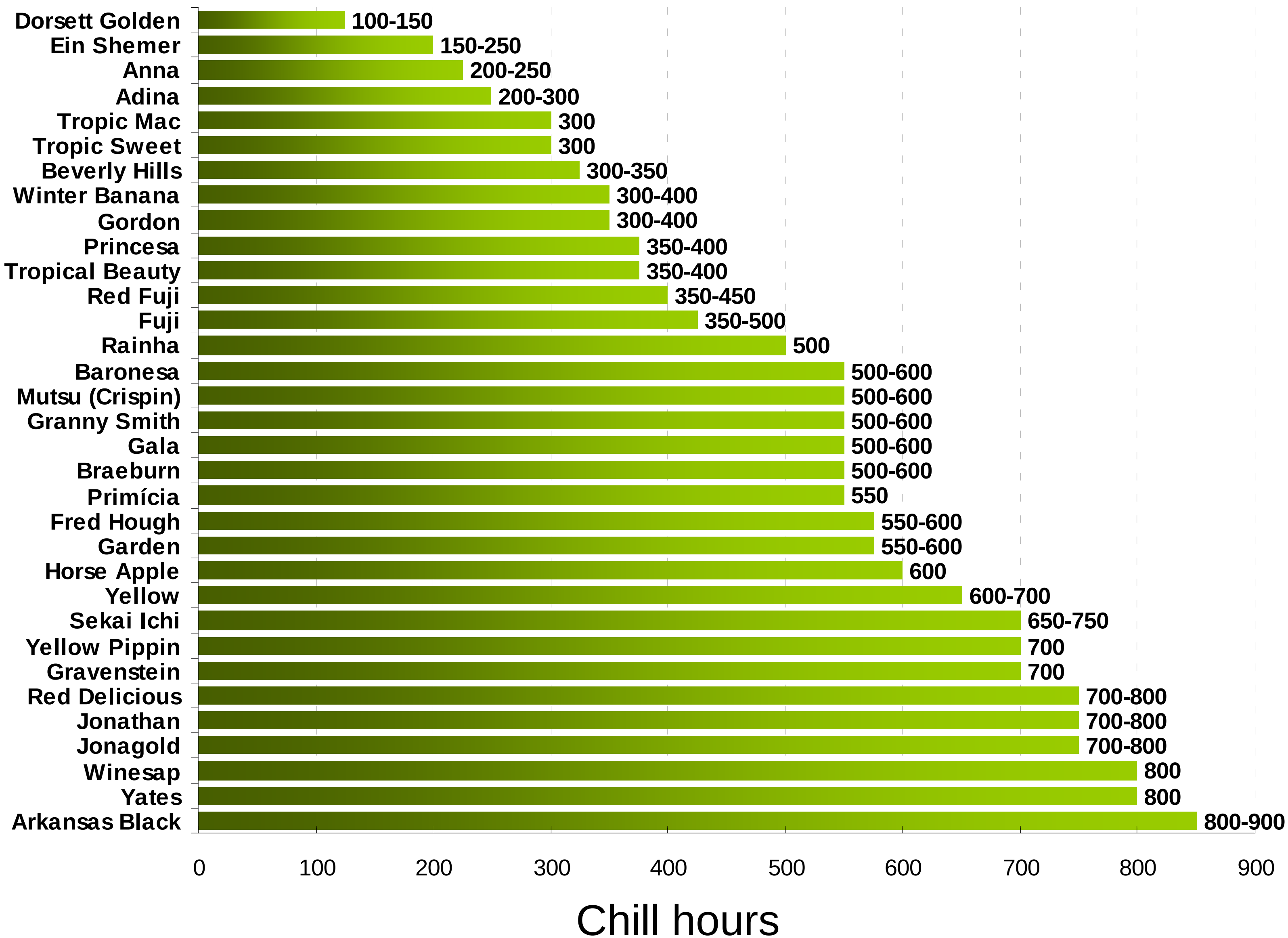
November – Sepals on lateral flowers



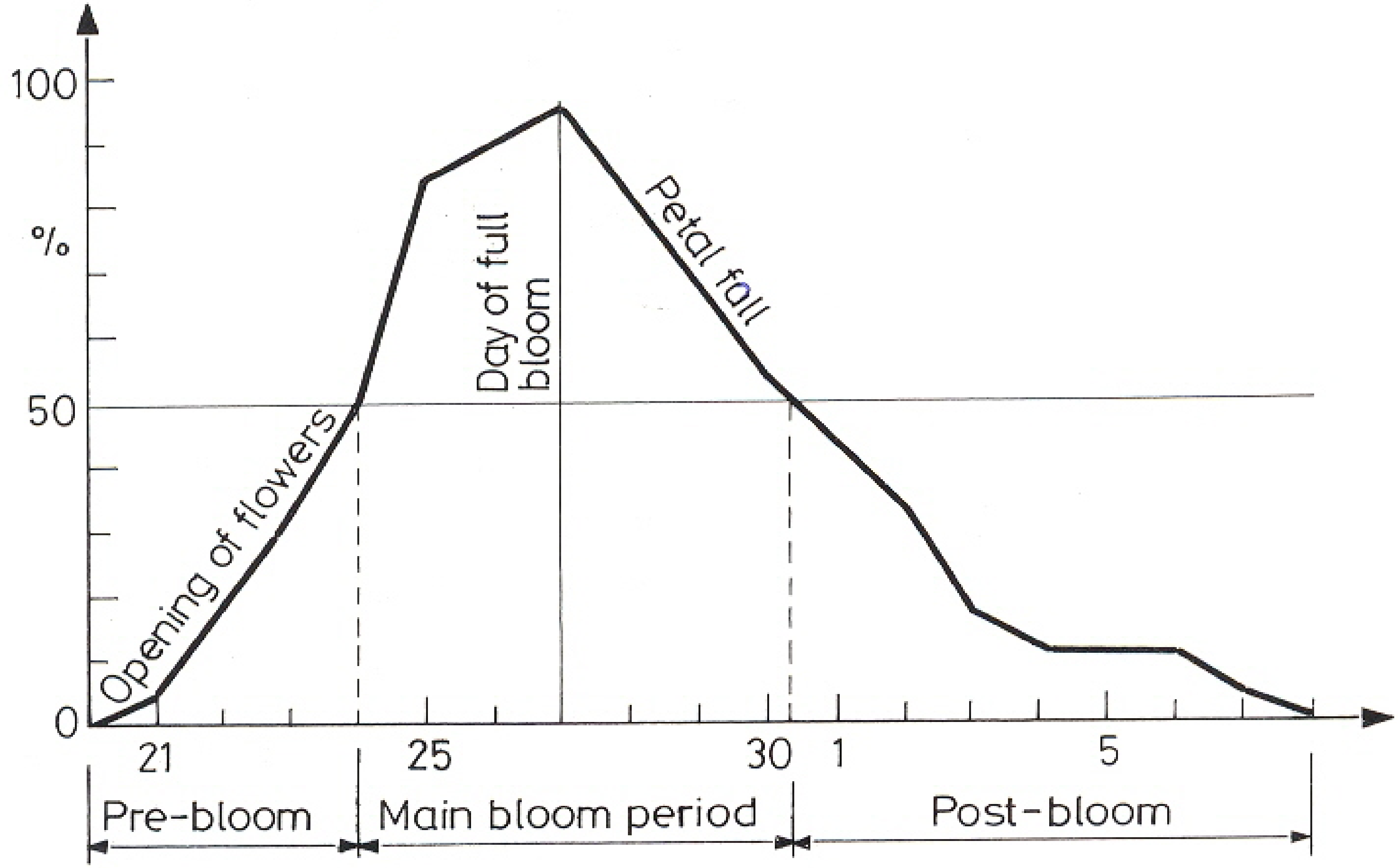
December-March predominantly dormant

Alternate bearing of apple

Chilling requirements of apple varieties



Flowering phenogram



The apple flower

Apple pollination by bees and other insects

Pollenizers

Thinning apple blossoms

Horticultural basis

- Trees produce an excessive number of flowers
- 5-10% final fruit set is needed to produce a desirable crop
- Improve fruit quality, fruit size
- Promote return bloom
- Maintain tree growth and structure
- Earlier thinning gives best responses

Several approaches to thinning

- Mechanical (dormant pruning)
- Mechanical (blossom thinning)
- Chemical thinning (blossom & fruitlet thinning)
- Hand thinning (follow-up thinning, after mechanical or chemical thinning)

Not Thinned

Thinned

prweb.com

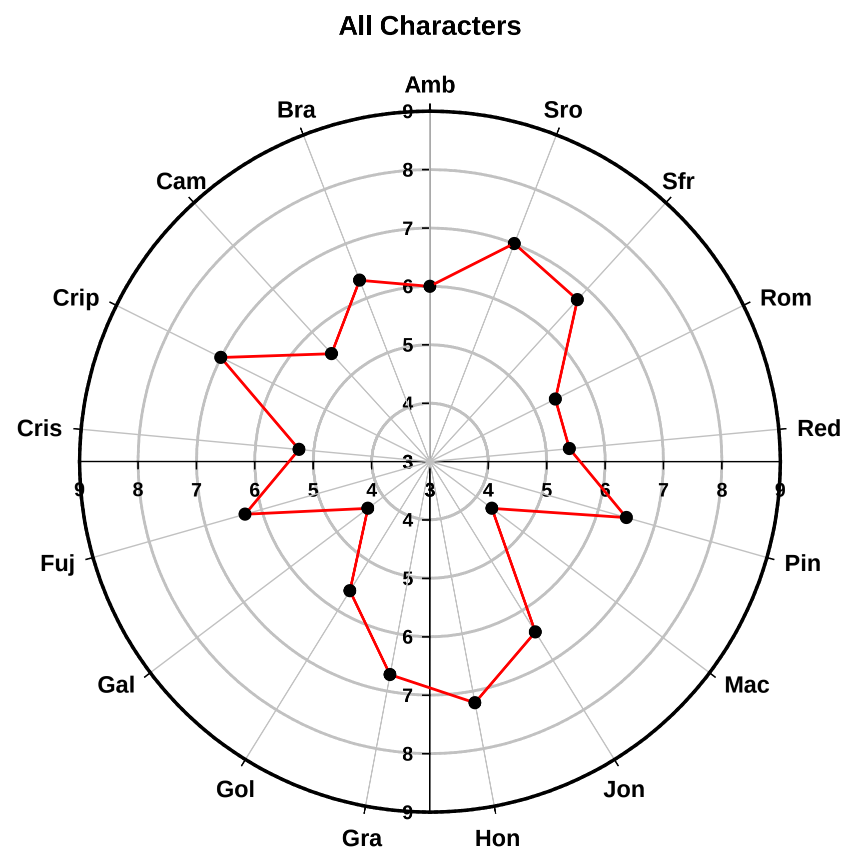
Cultivar	Date	Origin	Cultivar	Date	Origin
McIntosh	1811	Ontario	Honeycrisp	1960	Minnesota
Granny Smith	1868	Australia	Paula Red	1960	Michigan
Red Delicious	1870	Iowa	Empire	1966	New York
Cortland	1890	New York	Jonagold	1968	New York
Golden Delicious	1914	West Virginia	Cripps Pink	1970	Australia
Macoun	1923	New York	Gala	1970	New Zealand
Crispin (Mutsu)	1930	Japan	Ambrosia	1980	British Columbia
Fuji	1930	Japan	Cameo	1980	Washington
Braeburn	1952	New Zealand	Jazz	2007	New Zealand

HCS 5460
Physiology and Production of Fruit Crops

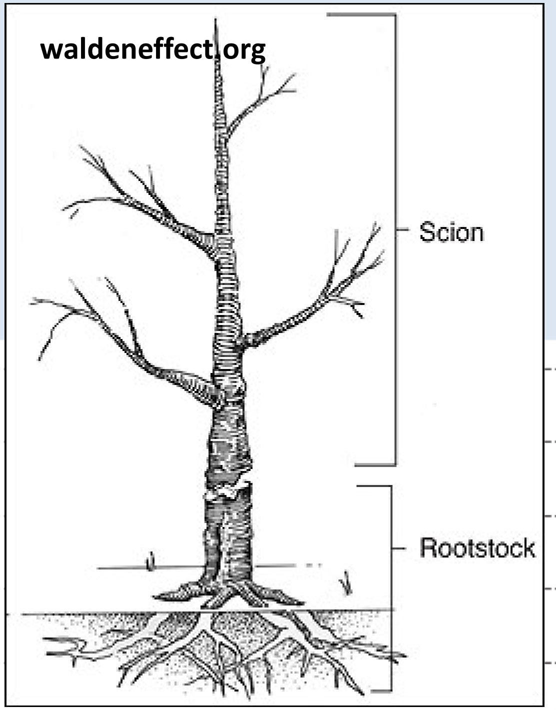
Apple Cultivar Evaluations

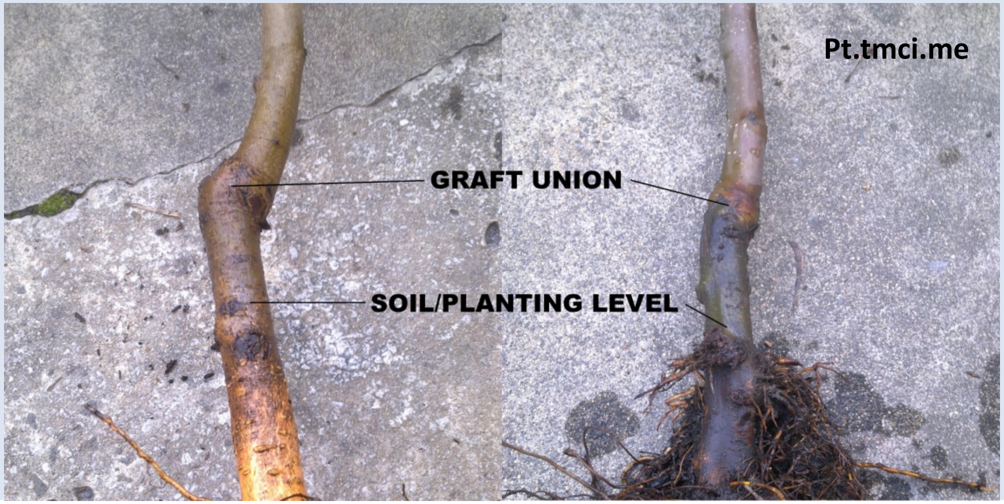
Characteristics	Sensory Data: Appear	Aroma	Sweet	Tart	Flav	Text	Over all
Appearance							
Aroma							
Sweetness							
Tartness							
Flavor			0.88				
Texture			0.66	0.71	0.77		
Over all characters	0.51		0.79	0.60	0.92	0.91	

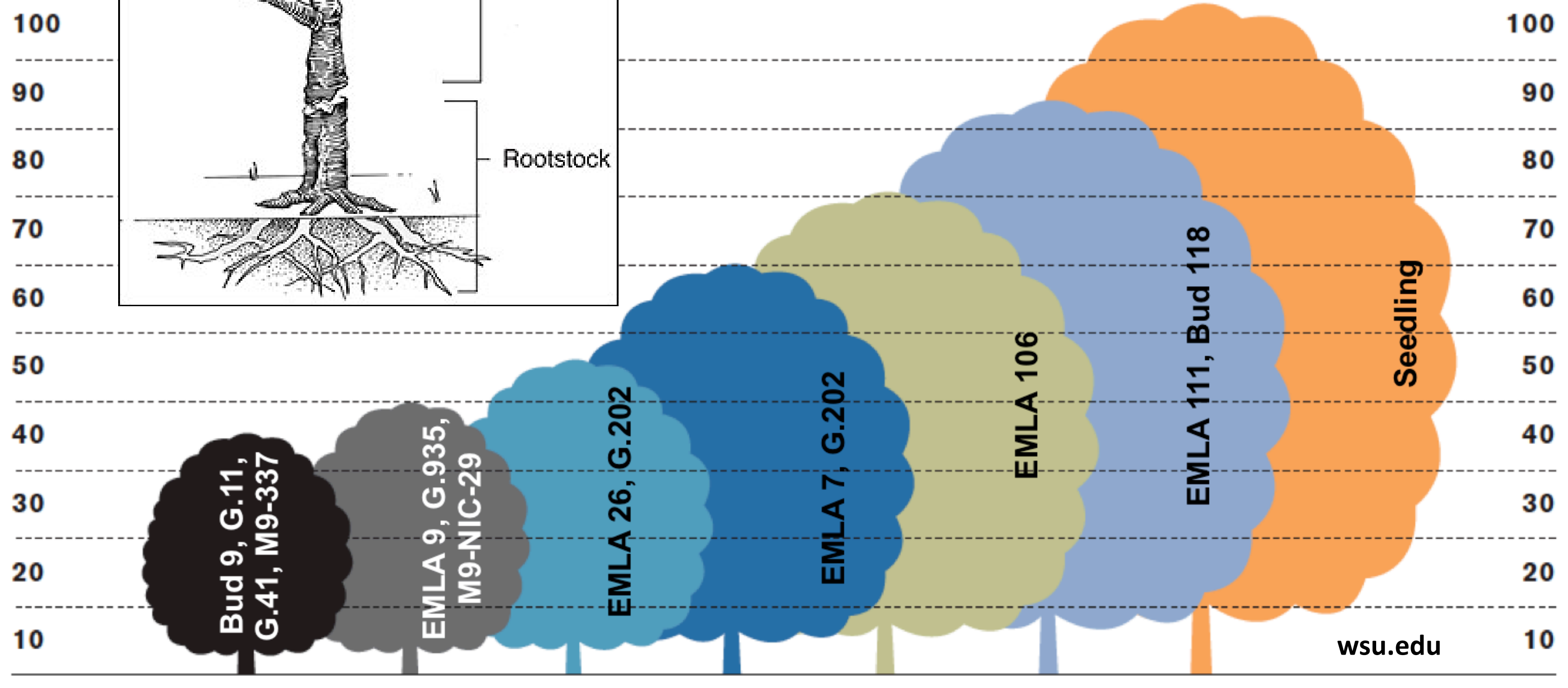
	Cultivar Name	Trade Mark Name
1	Ambrosia	
2	Braeburn	
3	Cameo	
4	Cripps Pink	Pink Lady
5	Crispin (Mutzu)	
6	Fuji	
7	Gala	
8	Golden Delicious	
9	Granny Smith	
10	Honeycrisp	
11	Jonagold	
12	Macoun	
13	Pinova	Pinata
14	Red Delicious	
15	Rome	
16	Scifresh	Jazz
17	Scirose	Pacific Rose



Apple Rootstocks



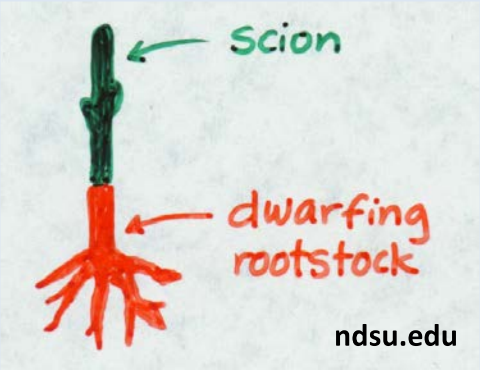


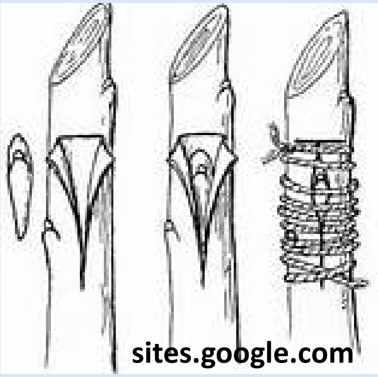


Apple Rootstocks

Rootstocks affect:

- Tree size and stature
- Vigor (yield to tree size ratio)
- Precosity
- Flowering and fruit set
- Fruit quality
- Cold hardiness
- Heat tolerance
- Disease and insect resistance





Rootstocks and Tree Vigor

(yield to tree volume ratio)

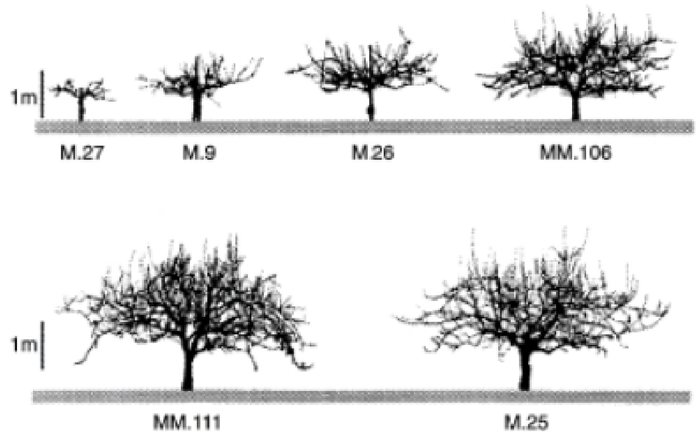


Fig. 5.5. Silhouettes of 'Cox's Orange Pippin' apple-trees grafted on a range of Malling and Malling–Merton rootstocks, showing their effect on scion vigour control.

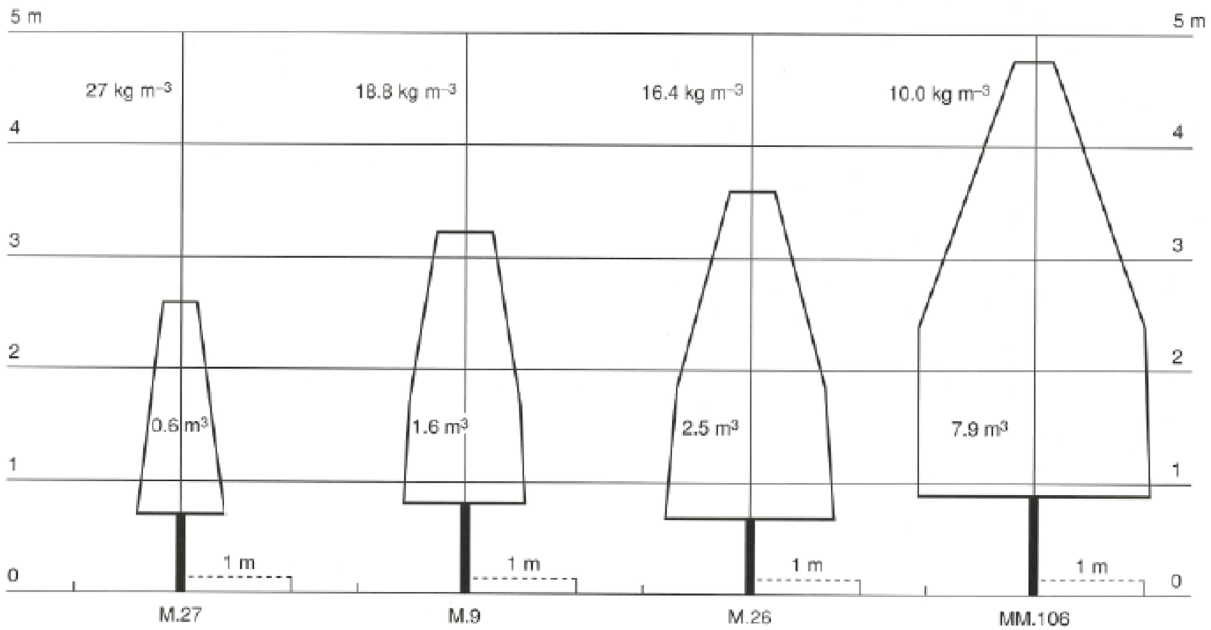
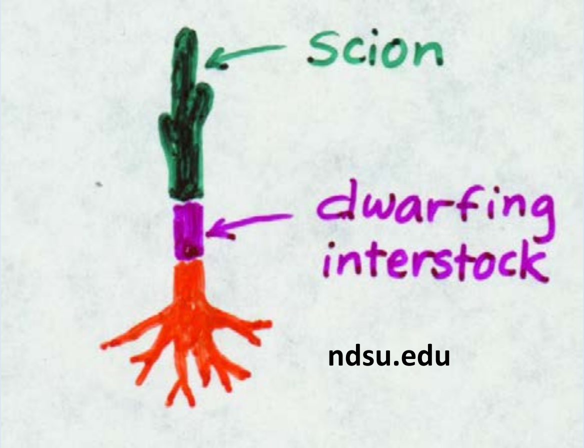


Figure 2.5 The effect of rootstocks 'M.27', 'M.9', 'M.26' and 'MM.106' on the canopy volume (m^3) and yield ($kg\ m^{-3}$) of 'Golden Delicious' apple trees, 7 years after planting. Reproduced from Lespinasse and Delort (1986) with permission.

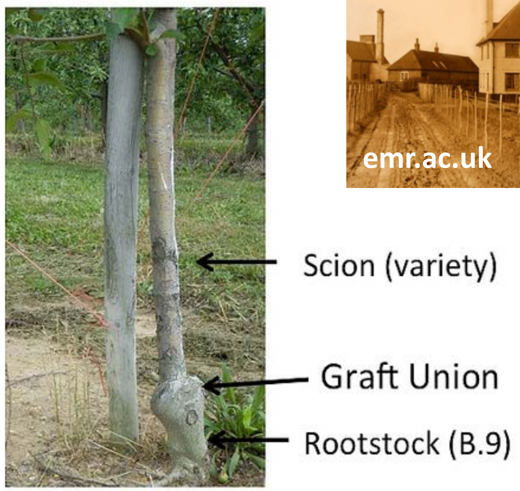
Apple Interstocks

Interstocks can:

- Control tree size and stature
- Overcome compatibility problems
- Overcome environmental barriers to rootstock use
- Improve cold hardiness
- Hasten fruit ripening



Apple Rootstock History



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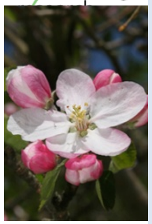
emr
east malling



topwalks.net

- Use of size-controlling rootstocks for 2000 yrs.
- Romans developed stocks from cuttings or suckers.
- Seedling rootstocks used in England – apple pomace as seed source
- First dwarfing rootstocks described in 16th and 17th Century European literature
- Mid 19th Century – use of French 'Paradise' and 'Doucin' or English 'Paradise'
- Late 19th Century – Ronald Hatton East Malling Research Station – selecting for trueness to type – assigning numbers (e.g., M.9)
- 1917 East Malling efforts joined by John Innes Institute in Merton – breeding rootstocks for woolly apple aphids (e.g., MM.106)
- 1960 Long Ashton Research Station joined effort to develop virus-free rootstocks (e.g., M.9EMLA)
- Recent programs from Russia (e.g., B.9), Poland (P.18) Germany (Pi.80) Canada (V.1, O.3) and the US (MARK, G.41)
- Rootstock evaluations by NC 140

Apple Rootstock/Interstem Development Programs

- Budagovski Series (Russia, ex. B9 or Bud. 9)
- Poland Series (Poland, ex. P.18)
- Pillnitzer Supporter Series (Germany, ex. Pi.80)
- Ottawa Series (Canada, ex. O.3)
- Vineland Series (Canada, ex. V.1)
- Geneva Series (New York, ex. G.65)
- Michigan Series (Michigan, ex. MARK)

See supporting materials for descriptions

Site Preparation and Planting

- •Optimum slope and exposure
- •Deep, well-drained soil
- •Ample organic matter
- •Slightly acidic (nearly neutral) pH

- •Remove unwanted vegetation
- •Subsoil to break hard pan
- •Level or contour the planting site
- •Soil test
- •Correct nutritional deficiencies
- •Plant sod-row middles
- •Purchase trees

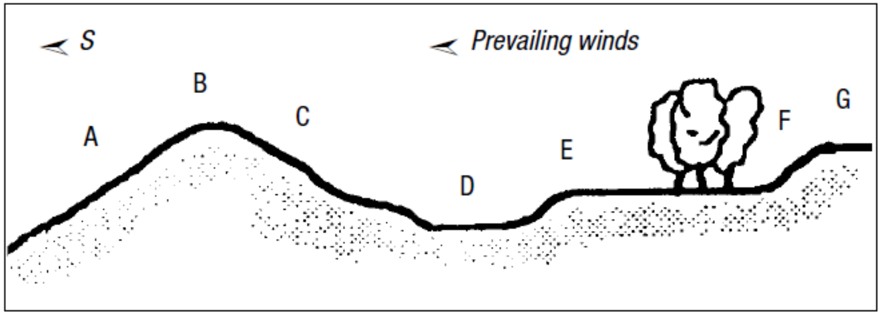


Figure 1-1. Considerations for orchard sites.

PA Tree Fruit Production Guide

Apple Training, Pruning and Production Systems

Heading and Thinning Cuts

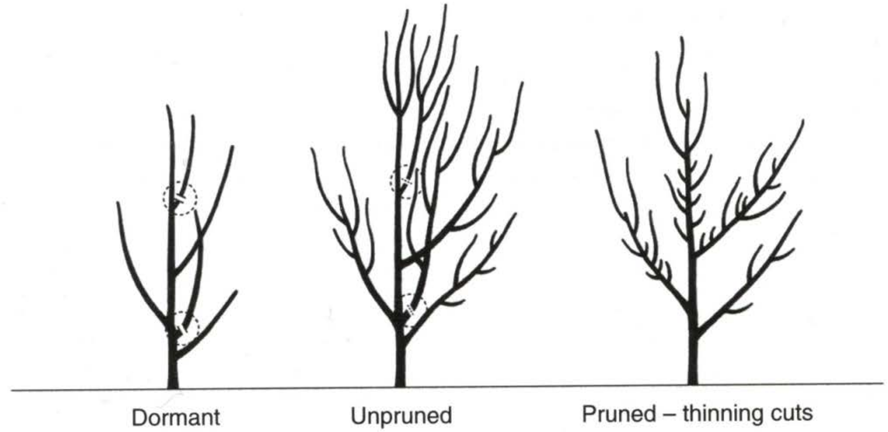


Fig. 14.2. Change in growth of an apple tree that received two dormant thinning cuts in year 1 (left-hand figure). Growth response at the end of year 2 is shown in the right-hand figure. The response for an unpruned tree is shown in the centre figure. In the latter case, main pruning cuts are needed in the second dormant season to restore a desired tree form but note that the advantages of lateral branch development and uniform fruit distribution have been lost.

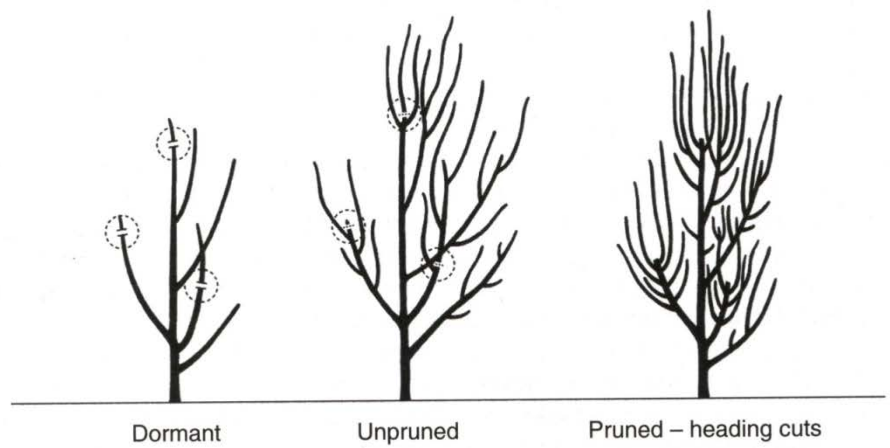
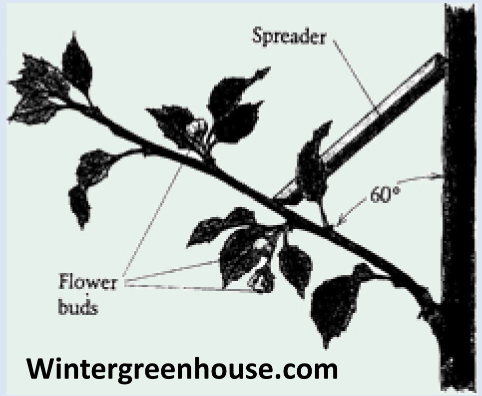


Fig. 14.3. Change in growth of an apple tree that received three heading-back pruning cuts in year 1 (left-hand figure). Growth response at the end of year 2 is shown in the right-hand figure where lateral branch development is strong and vigorous upright growth is apparent. The unpruned tree (centre figure) has a more spreading growth form with less lateral branching.

Ferree and Schupp, 2003

Branch Bending



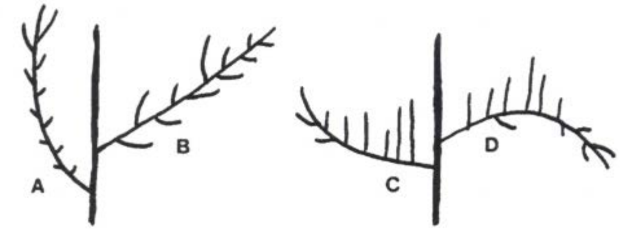


Figure 3. Branch orientation can affect shoot growth and flower bud development. A. Vertical shoots produce spurs, few side limbs. B. Limbs that are spread 60-45° produce side limbs of moderate vigor and spurs. C. Limbs that are spread below 45° may develop extensive upright growth that is non-fruitful. D. When the terminal is not the highest point on the limb, extension growth stops and new vigorous shoots develop from the highest point on the limb.

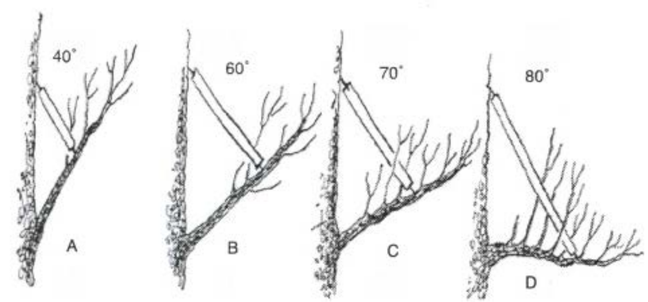


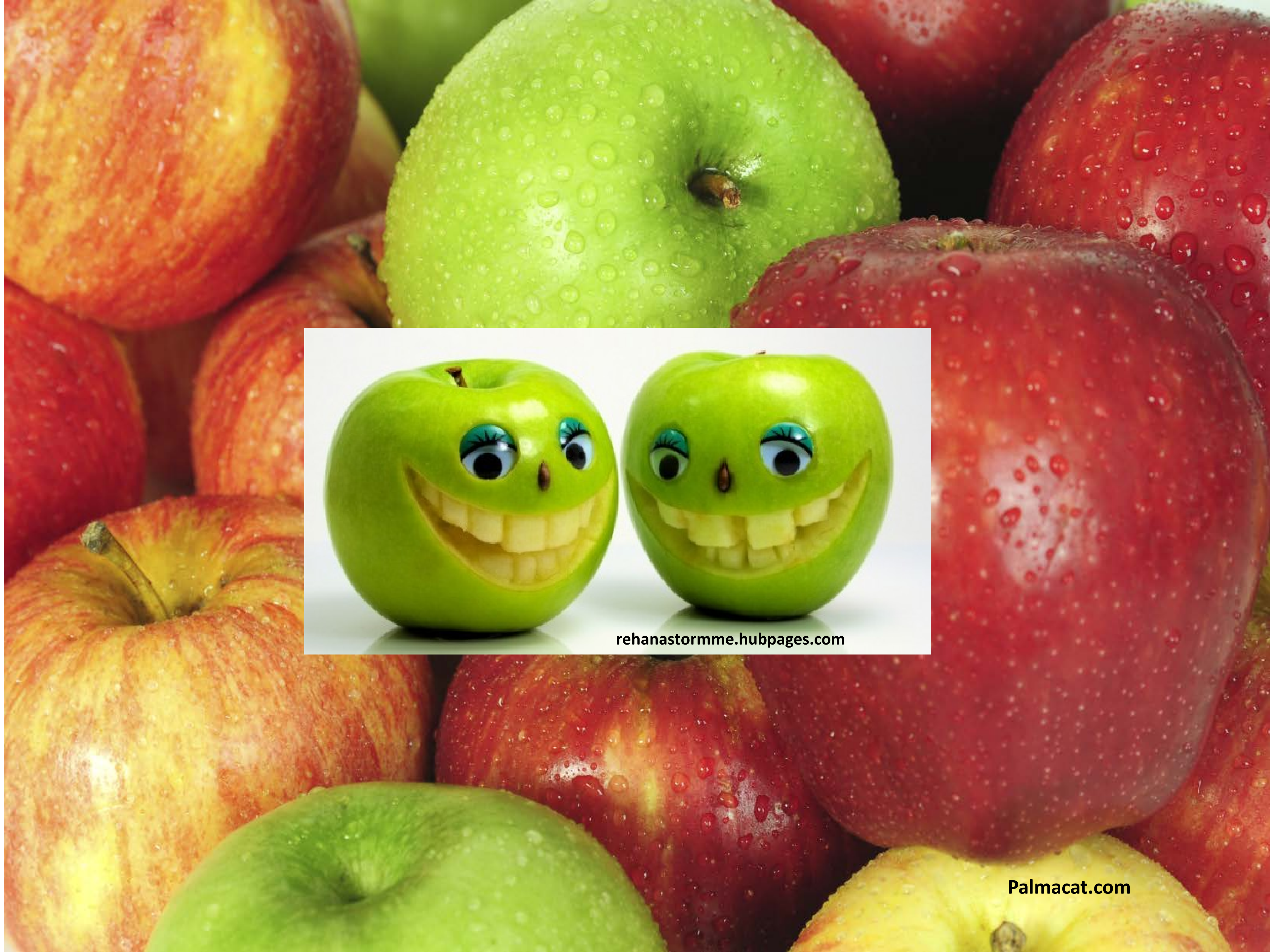
Figure 9. Auxin distribution within a stem is controlled by gravity. When limbs are oriented from vertical to about 60 degrees from vertical, auxin is distributed fairly evenly around the limb and buds develop into shoots fairly symmetrically around the limb (A and B). Auxin accumulates on the underside of flat limbs (C and D) and inhibits growth of buds on the underside. Auxin concentration is low on the upper side and buds are not inhibited and develop into strong watersprouts.

Ferree and Schupp, 2003

Pruning an Older Tree

Figure 9. A six-year-old 'Delicious' tree (Left) before spreading, (Middle) after spreading, and (Right) after pruning. The weight of a crop will pull the scaffold branches down to form the conical tree shape. Note the removal of many limbs in the top half of the tree to allow light penetration.

Marini 422-021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