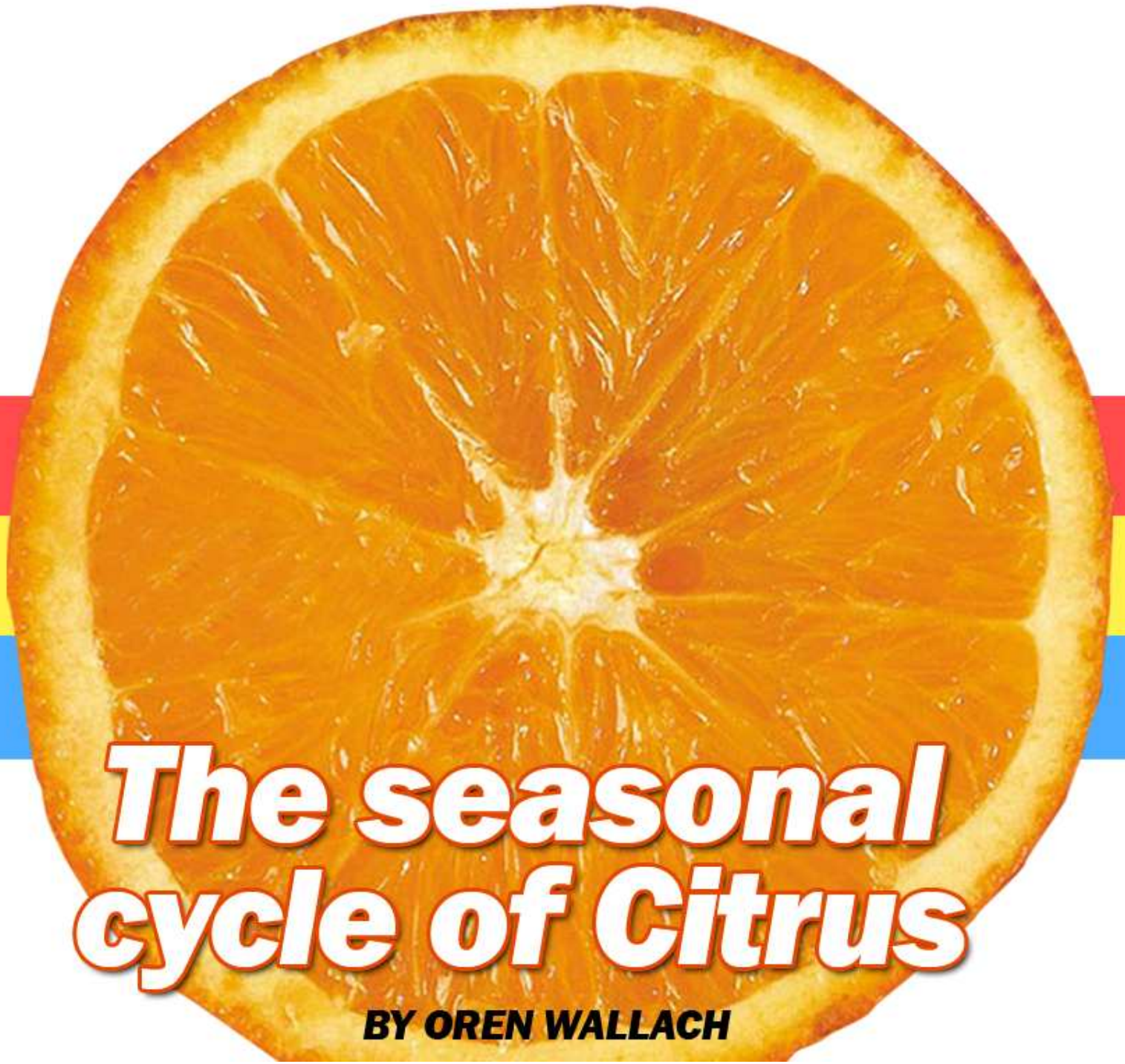
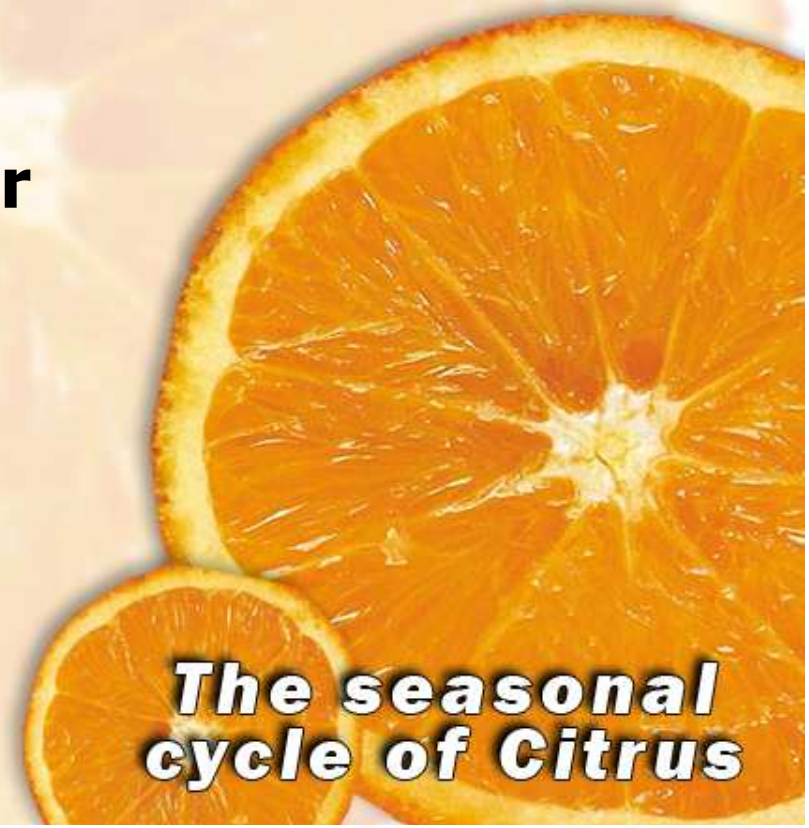


The seasonal cycle of Citrus

BY OREN WALLACH

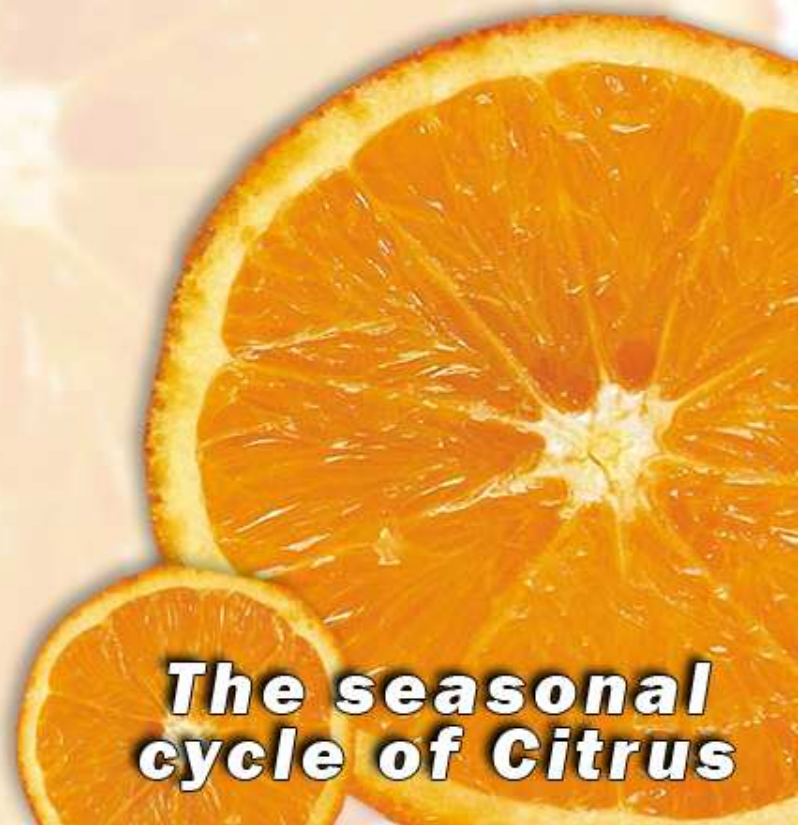
Citrus is a perennial evergreen tree.
The economic life expectancy is 25 years.
But there are trees that can live 100 years and more

Leaves stay on citrus tree for 1 to 2 years.
They are replaced continually



Premature leaf drop is triggered by:

* High temperatures
* Wind
* Low soil moisture
* Low relative humidity
* Nutrient deficiencies
* High soil salinity
* Diseases
* Insects

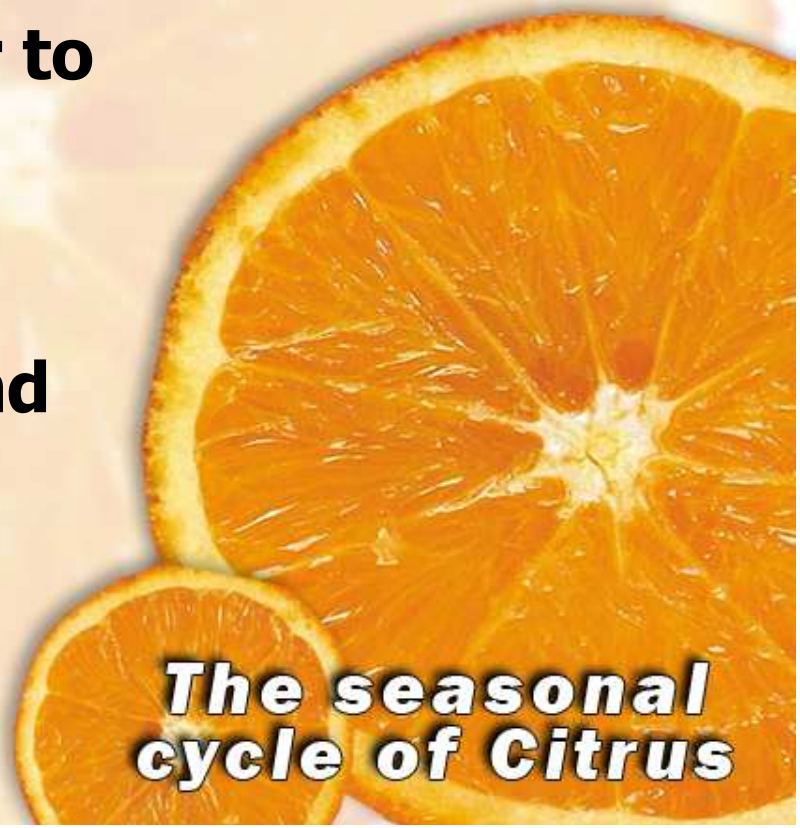


Kinds of cultivars

Self compatible- can be fertiled by their own pollen.

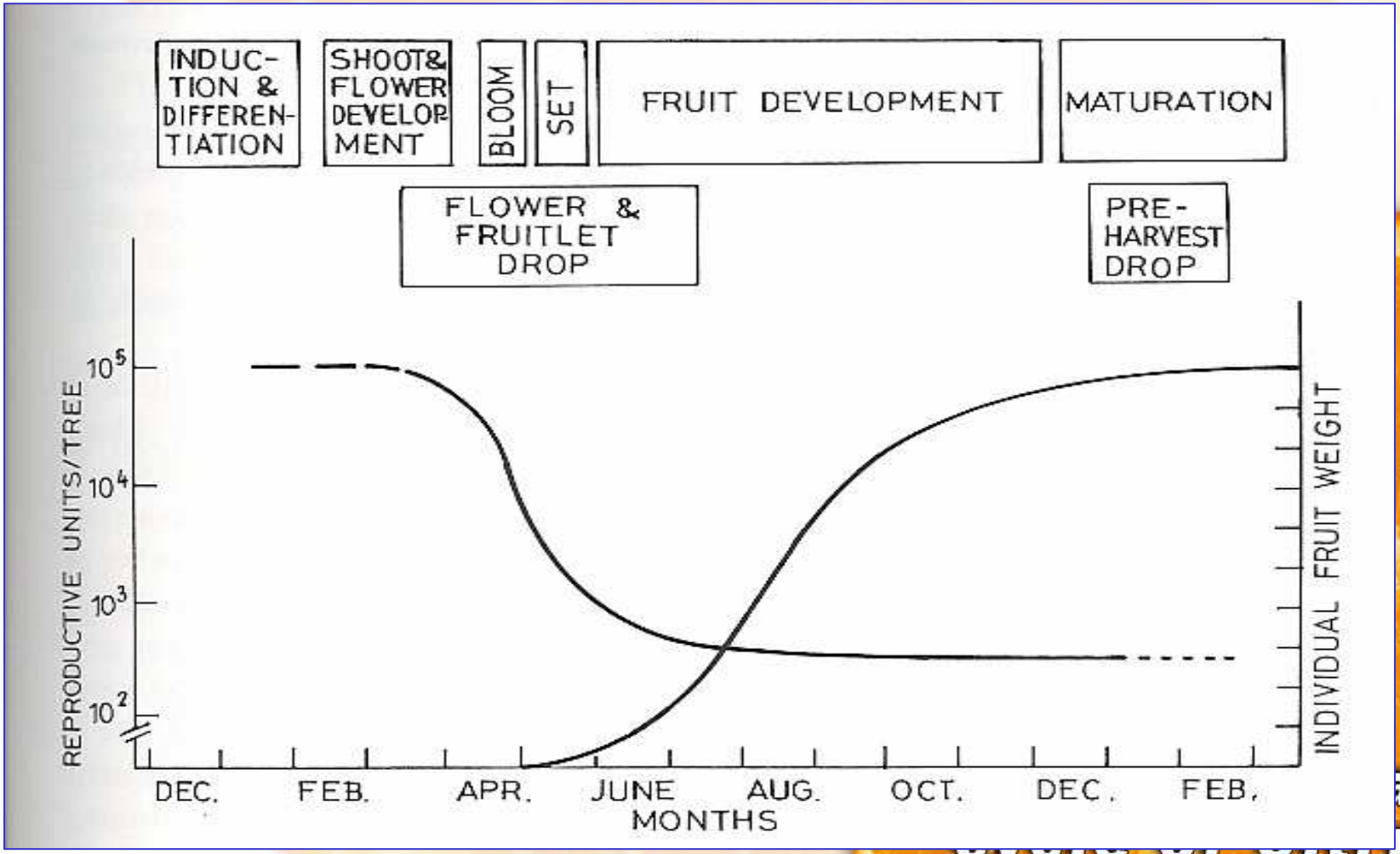
Self incompatible- require pollination by another cultivar to set fruit

Parthenocarpic – can produce fruit without being fertilied and without seed formation ('Satsuma' mandarin)



Scematic description of annual cycle of crop production in a citrus tree

(from Goldshmidt and Monselise 1978 Israel)

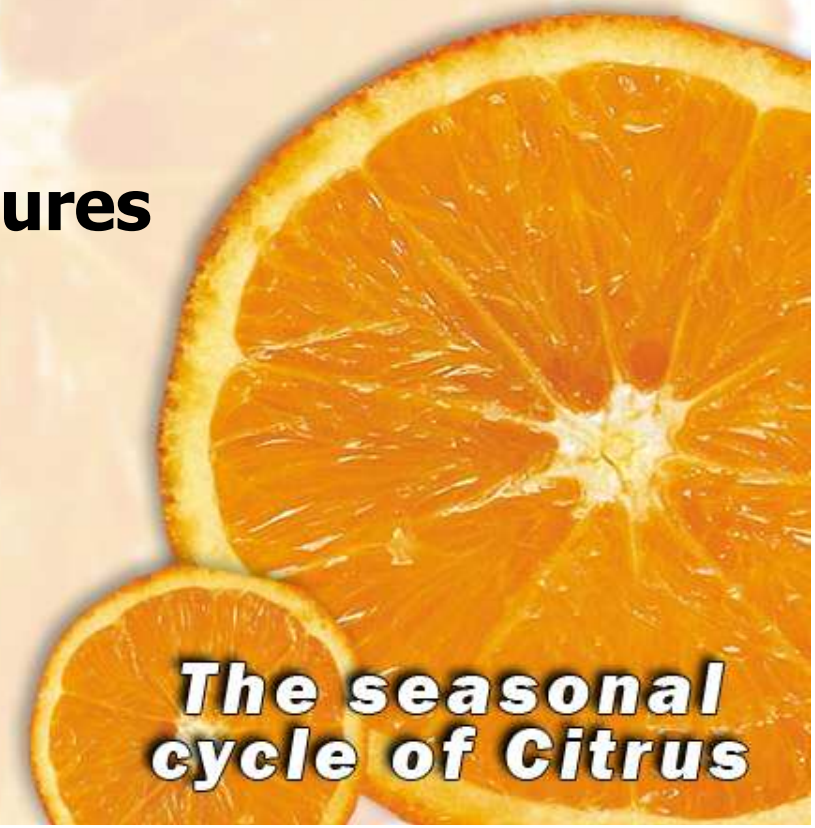


Floral induction

Citrus trees need a period of two months rest from active vegetative growth prior to flower induction.

1. Cool temperatures

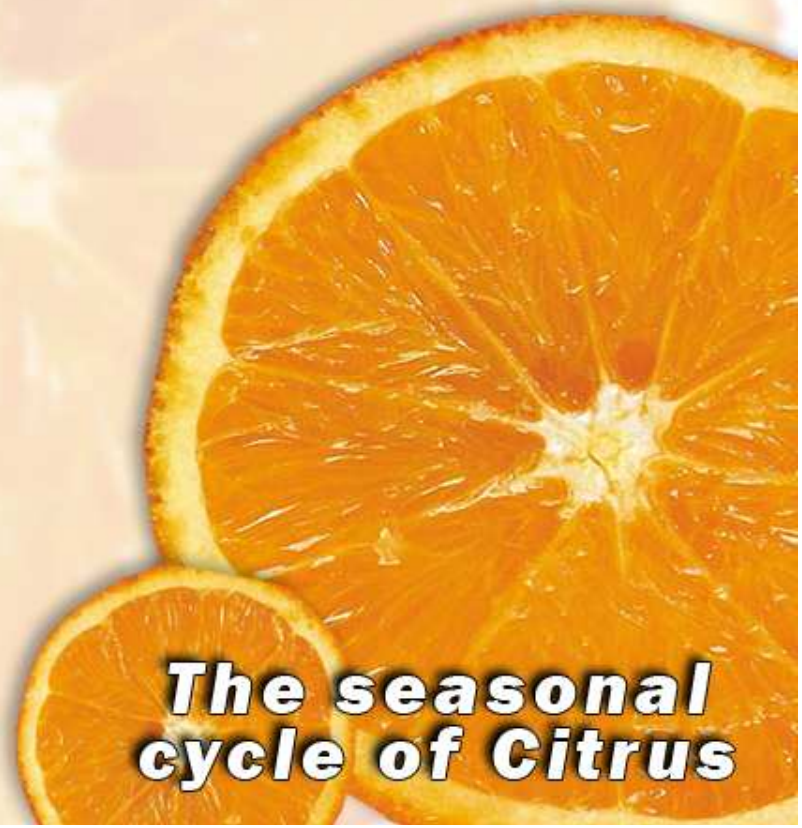
(lower than 13^0 C).
The chilling winter temperatures are involved in the floral induction of citrus in the subtropical regions.



2. Water stress

Is the flower inducing signal under semi- tropical conditions. (Ca. 2 months without irrigation).

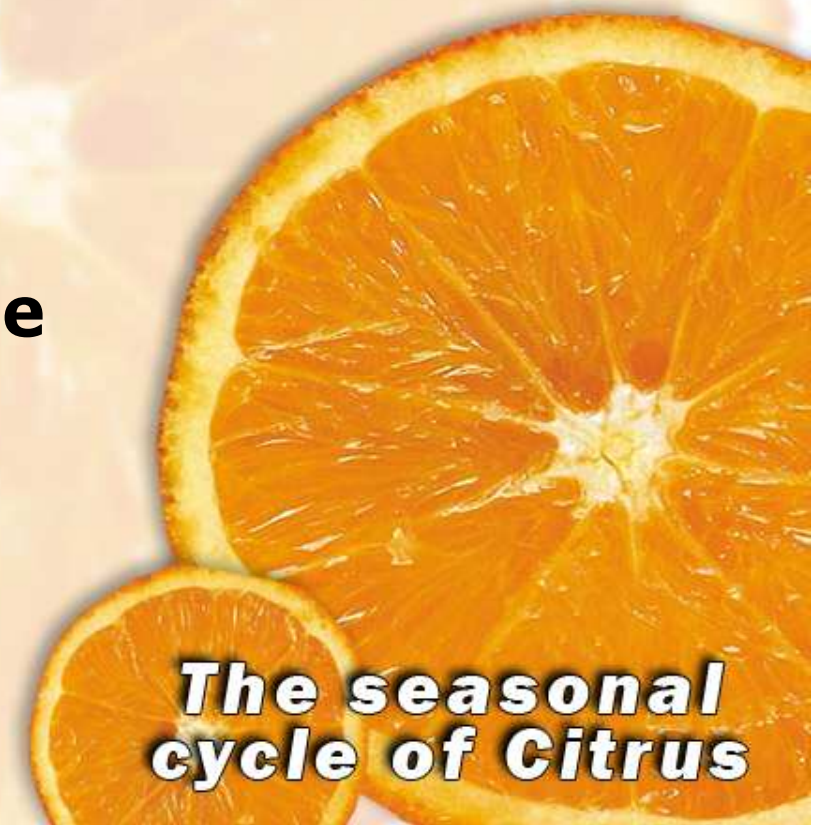
Ca. 1 month after irrigation blossom will appear.



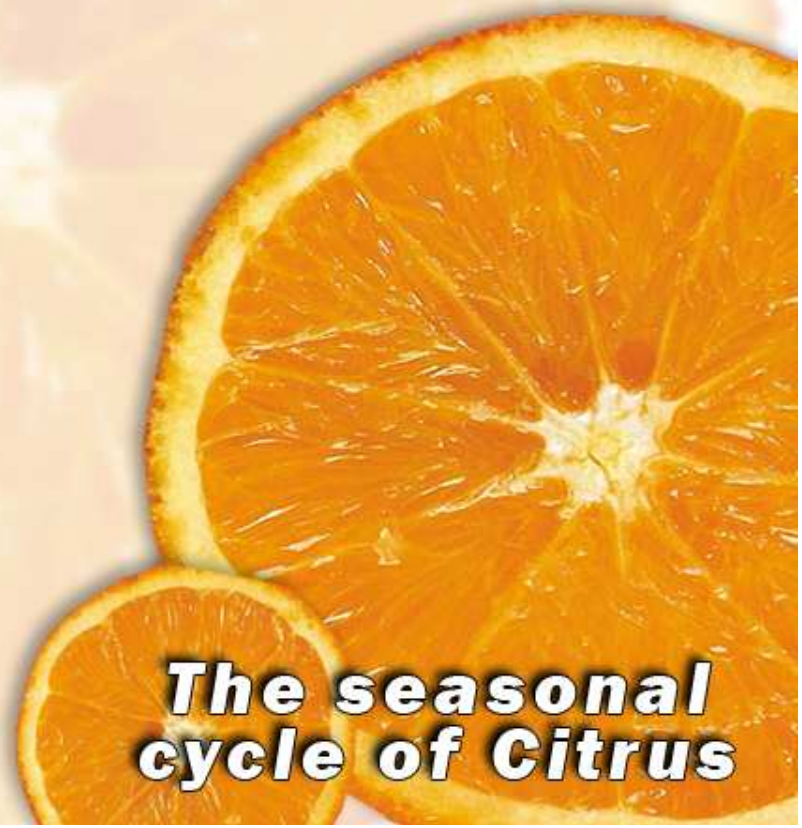
Flowering

Flowers are formed on flowering branches called inflorescence. Inflorescences develop in leaf axils on shoots of preceding growth flushes

Inflorescences may bear one to many flowers.

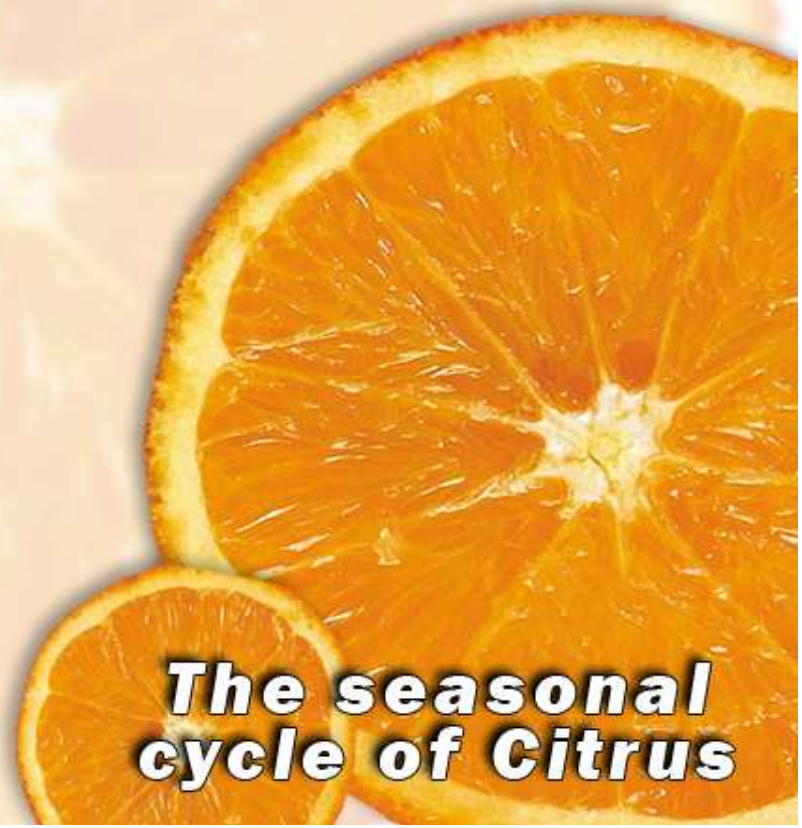


Leafy inflorescence:
inflorescence with leaves and flowers.



Leafless inflorescence

inflorescence with flowers without - leaves.-

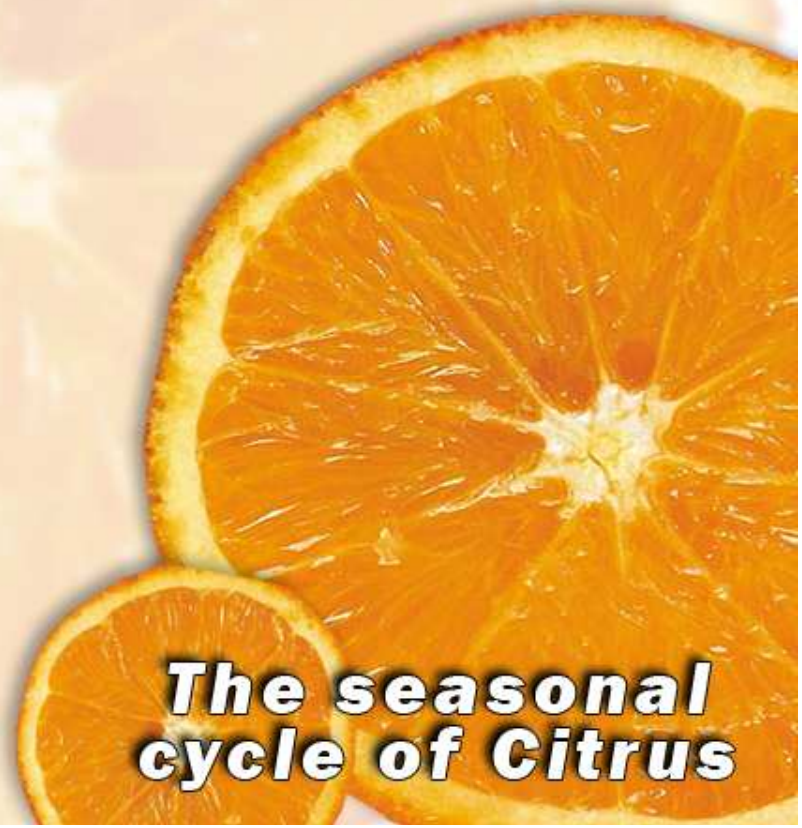


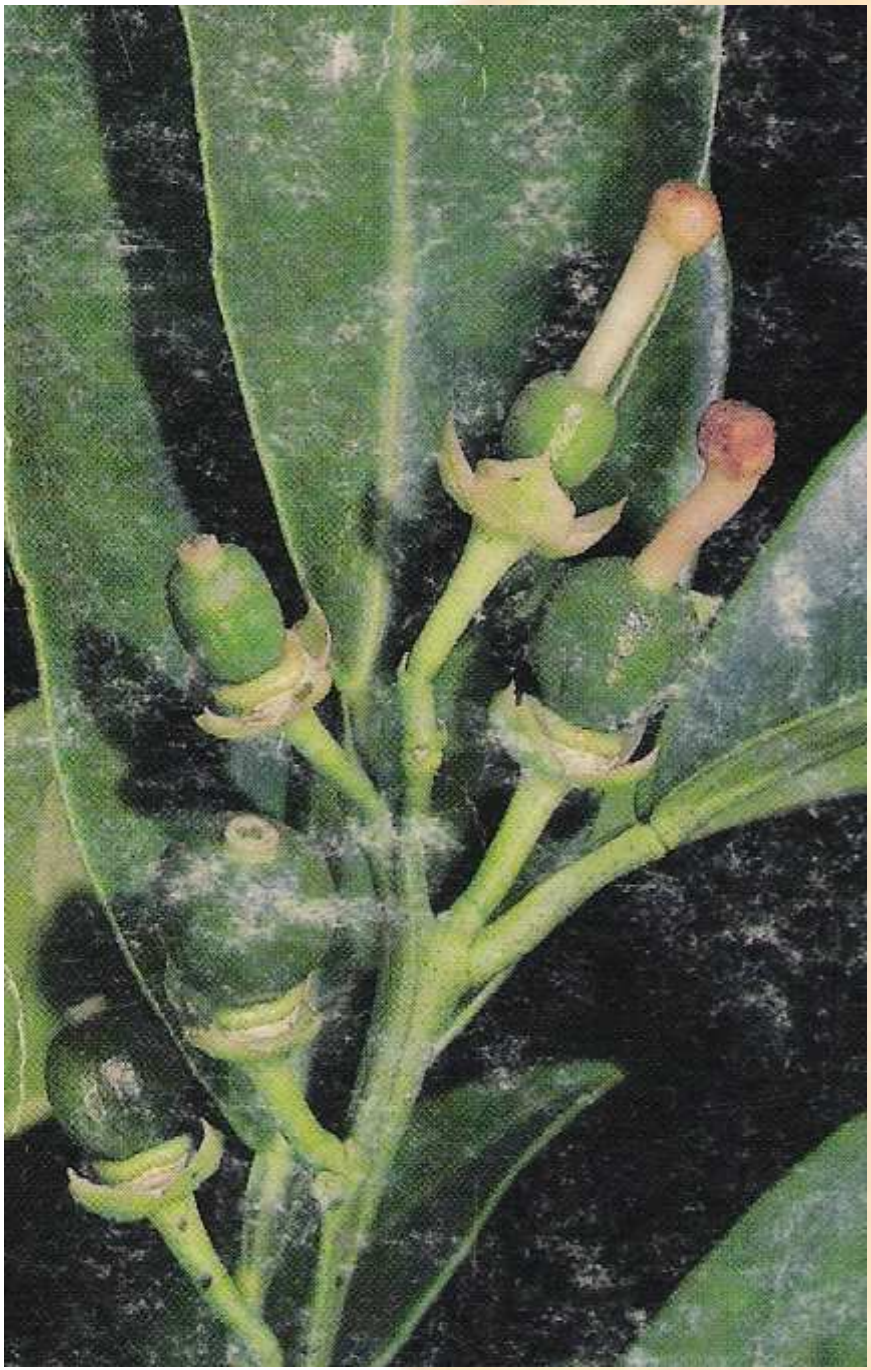
Fruit set

Is the stage when small fruitlets develop from flowers.

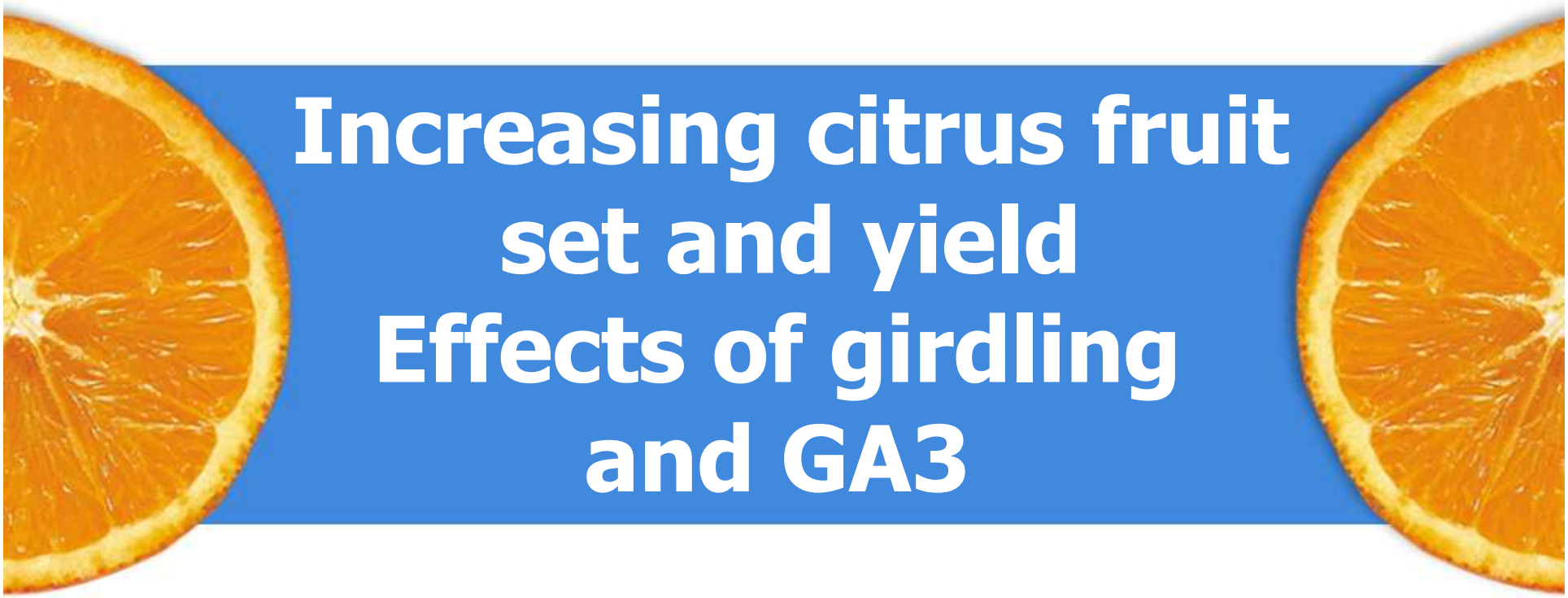
Citrus usually bloom abundantly but most of flowers and fruit drop.

Persistent fruitlets are generally borne on leafy inflorescences, with low flower to leaf ratio.





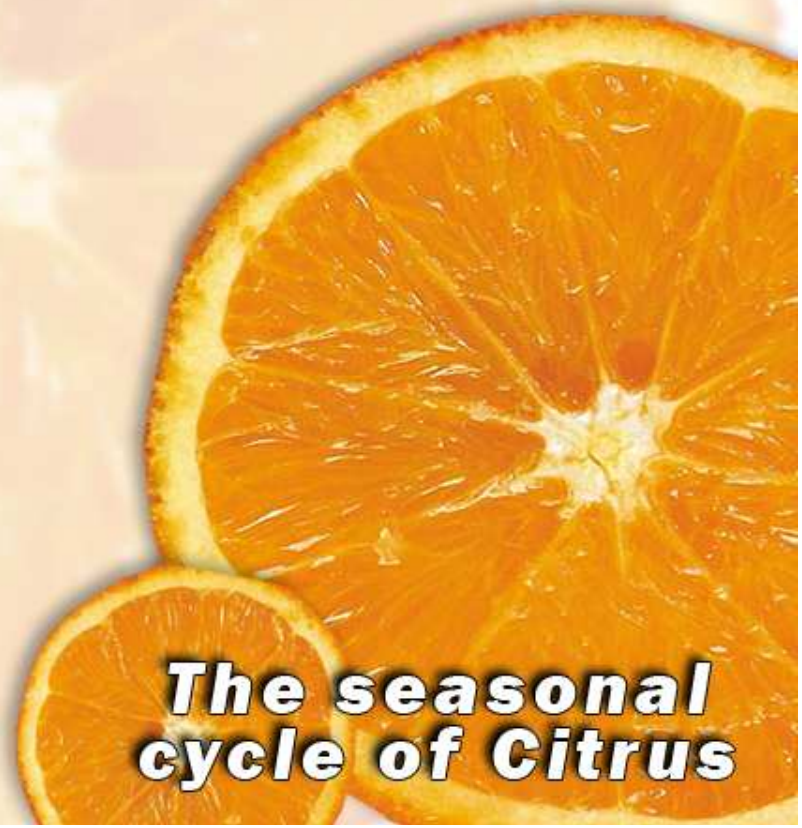
The seasonal cycle of Citrus

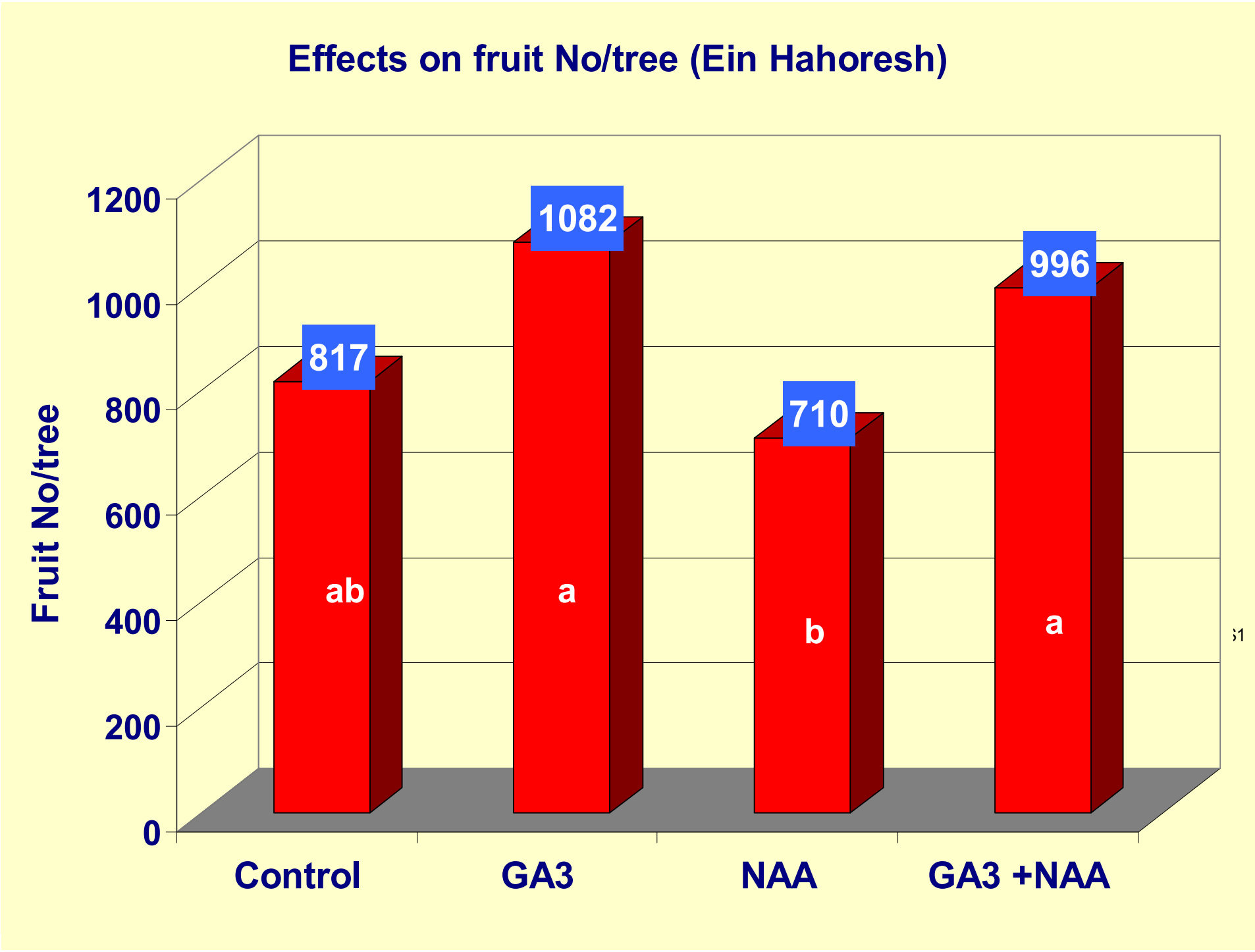

Increasing citrus fruit
set and yield
Effects of girdling
and GA3

GA3 spray

The plant hormone gibberellic acid is essential for fruitlet survival.
Spray with GA3 on full bloom increases fruit set. It causes fruitlet survival and increases yield.

The treatment is efficient in mandarins and not in other citrus varieties.



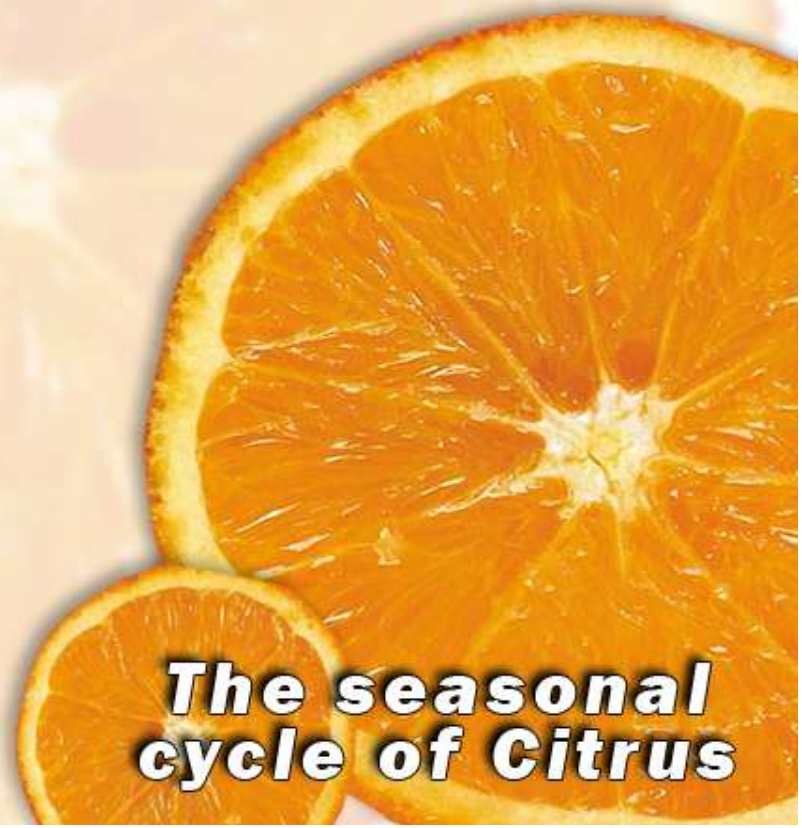

Effects on fruit No/tree (Ein Hahoresh)
Fruit No/tree
1200
1000
800
600
400
200
0
817
1082
710
996
ab
a
b
a
Control
GA3
NAA
GA3 +NAA

Girdling

A strip of bark is removed from the trunk or the branches.
It causes temporary disruption of conductive vessels (phloem) that carry carbohydrates to the roots.

More carbohydrates remain in the canopy which enable better fruit set.

After a few weeks phloem regenerates.

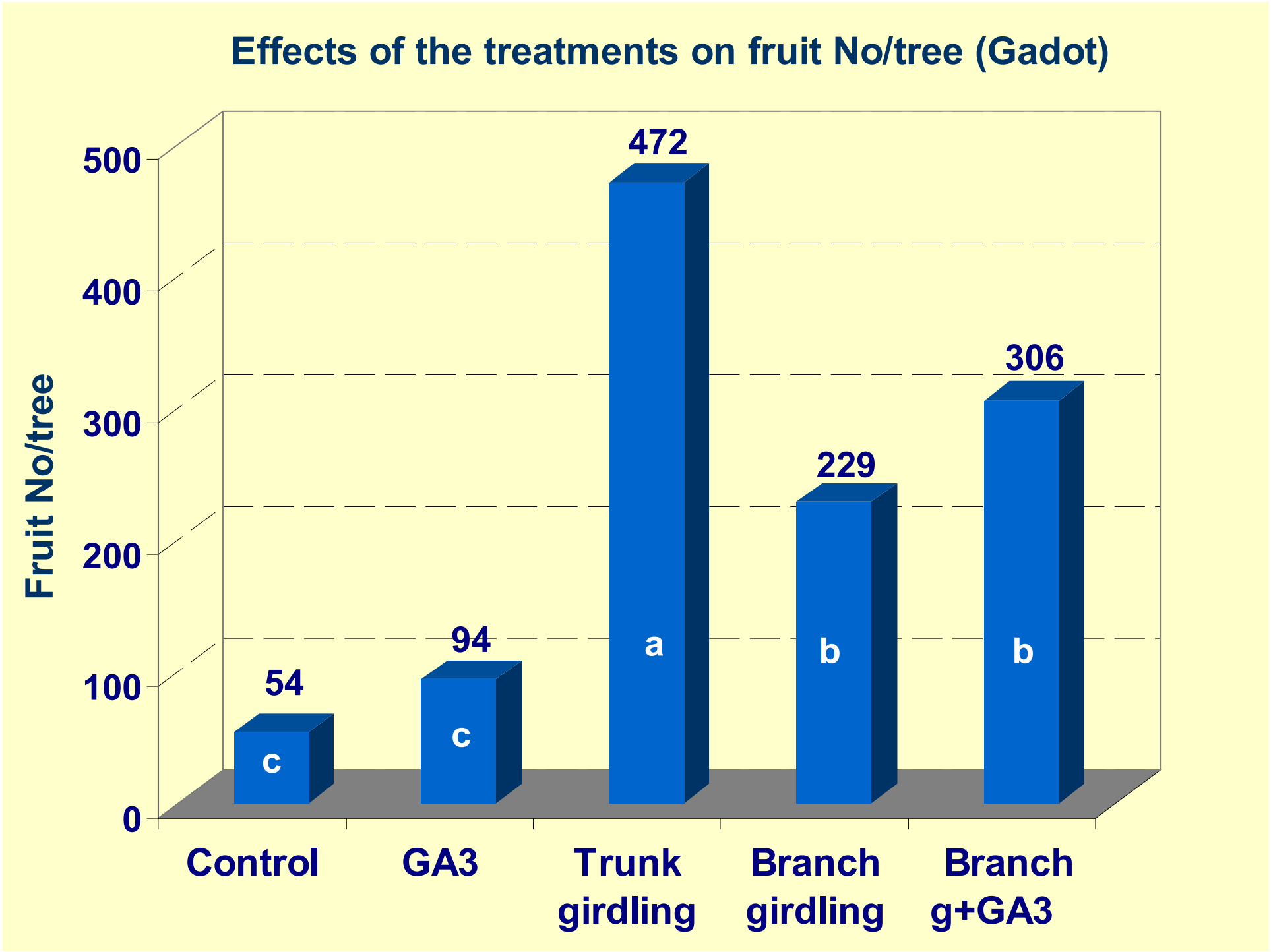


Girdling knife

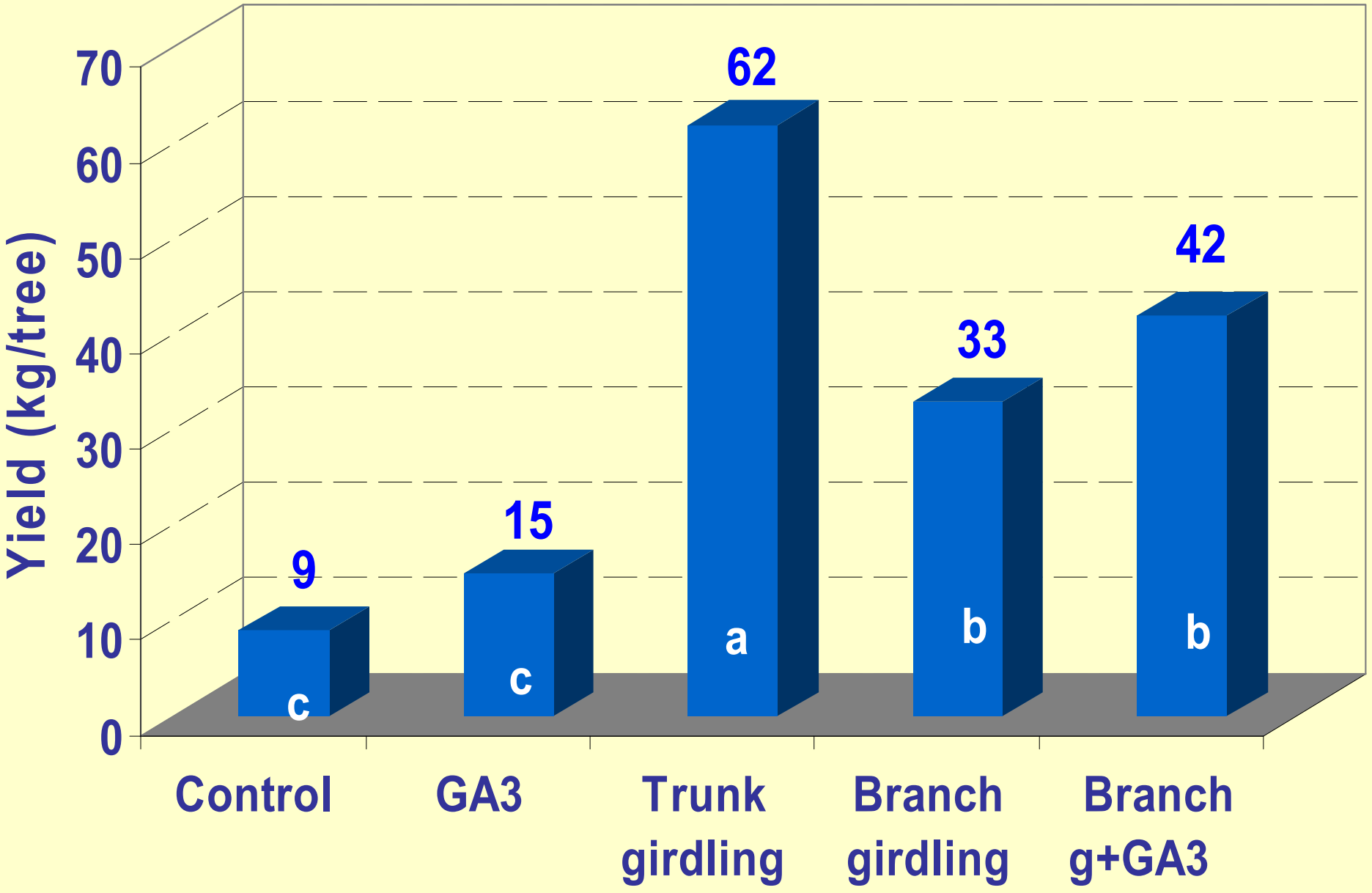
BAD GIRDLING

A TREE AFTER GIRDLING

A TREE AFTER GIRDLING


Effects of the treatments on fruit No/tree (Gadot)
Fruit No/tree
500
400
300
200
100
0
54
c
94
c
472
a
229
b
306
b
Control
GA3
Trunk girdling
Branch girdling
Branch g+GA3

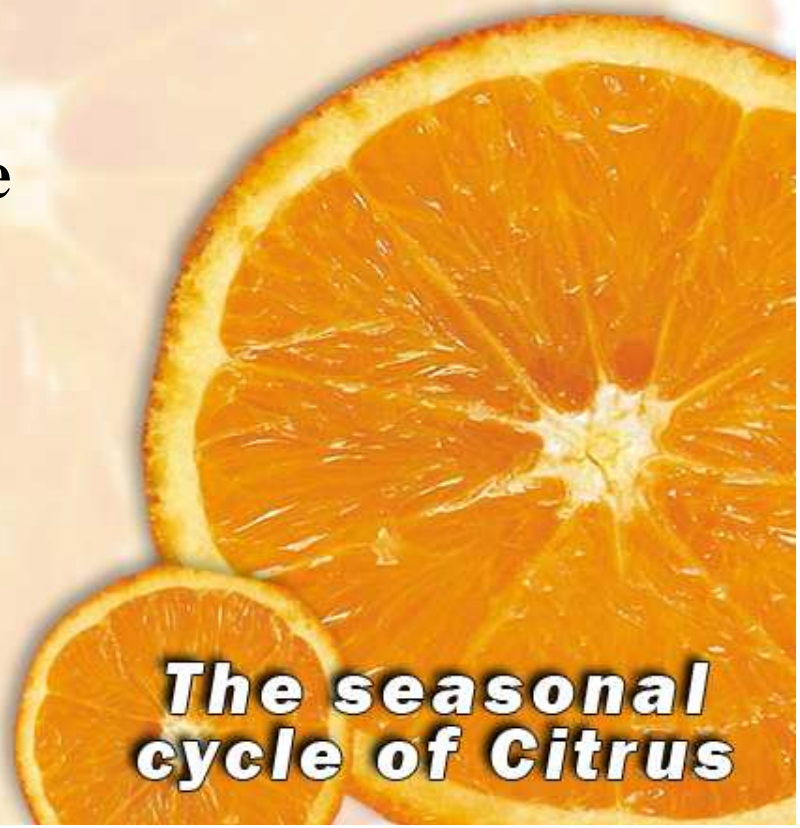
Effects on yield (Gadot)



Cell division in the young fruitlet

The young fruitlet undergoes rapid cell division for up to 9 weeks.

Growth during this time is due to increasing peel thickness.

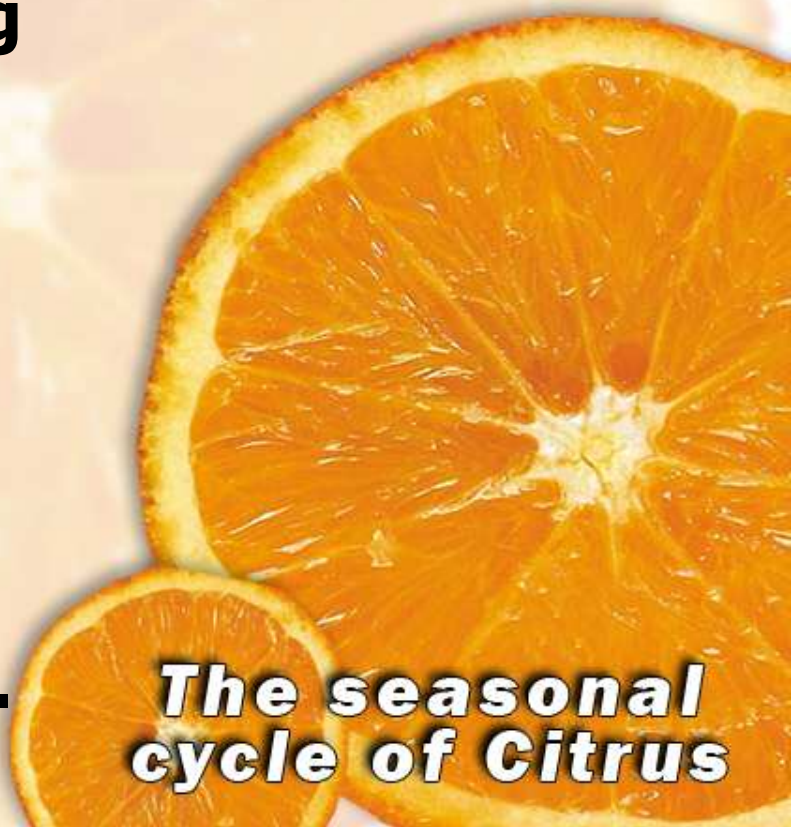


Young fruitlet drop

Fruitlet abscission is a self thinning mechanism which adjusts the number of fruit to the tree's bearing potential.

Fruitlet drop commence during bloom and continues till the fruiltlet are 15 – 30 mm in their diameter (in different varieties).

Stress conditions (high temperatures, water deficiency) increase fruit drop.



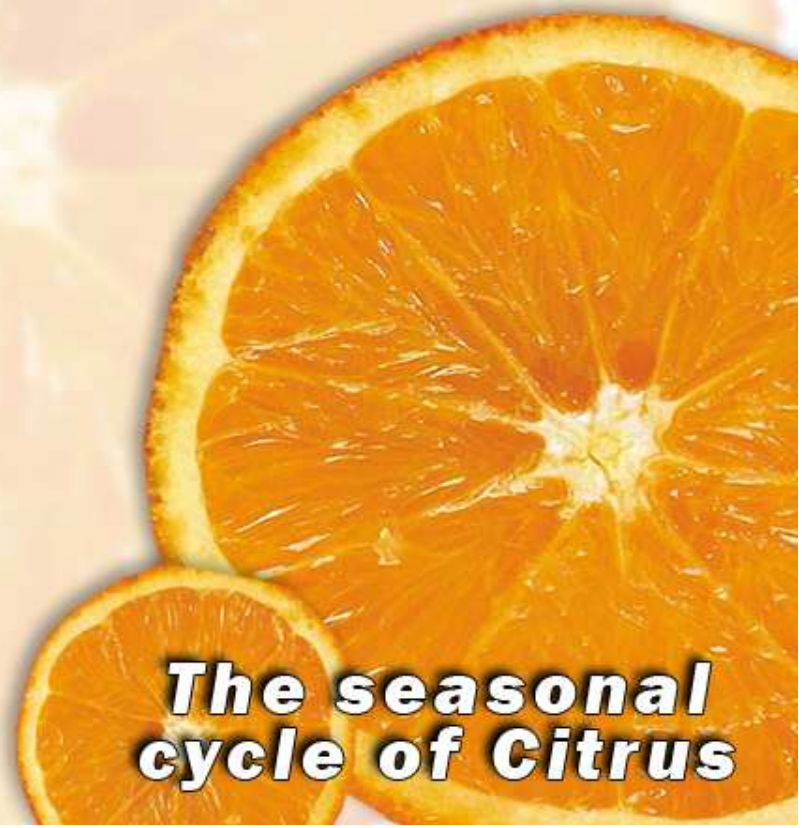
In the cultural practice, fruit thinning is used in varieties with over cropping

Fruit development and maturation

Cell enlargement- Juice sacks enlarge
and fill the segments.

Pulp increase

Peel thickness is reduced.



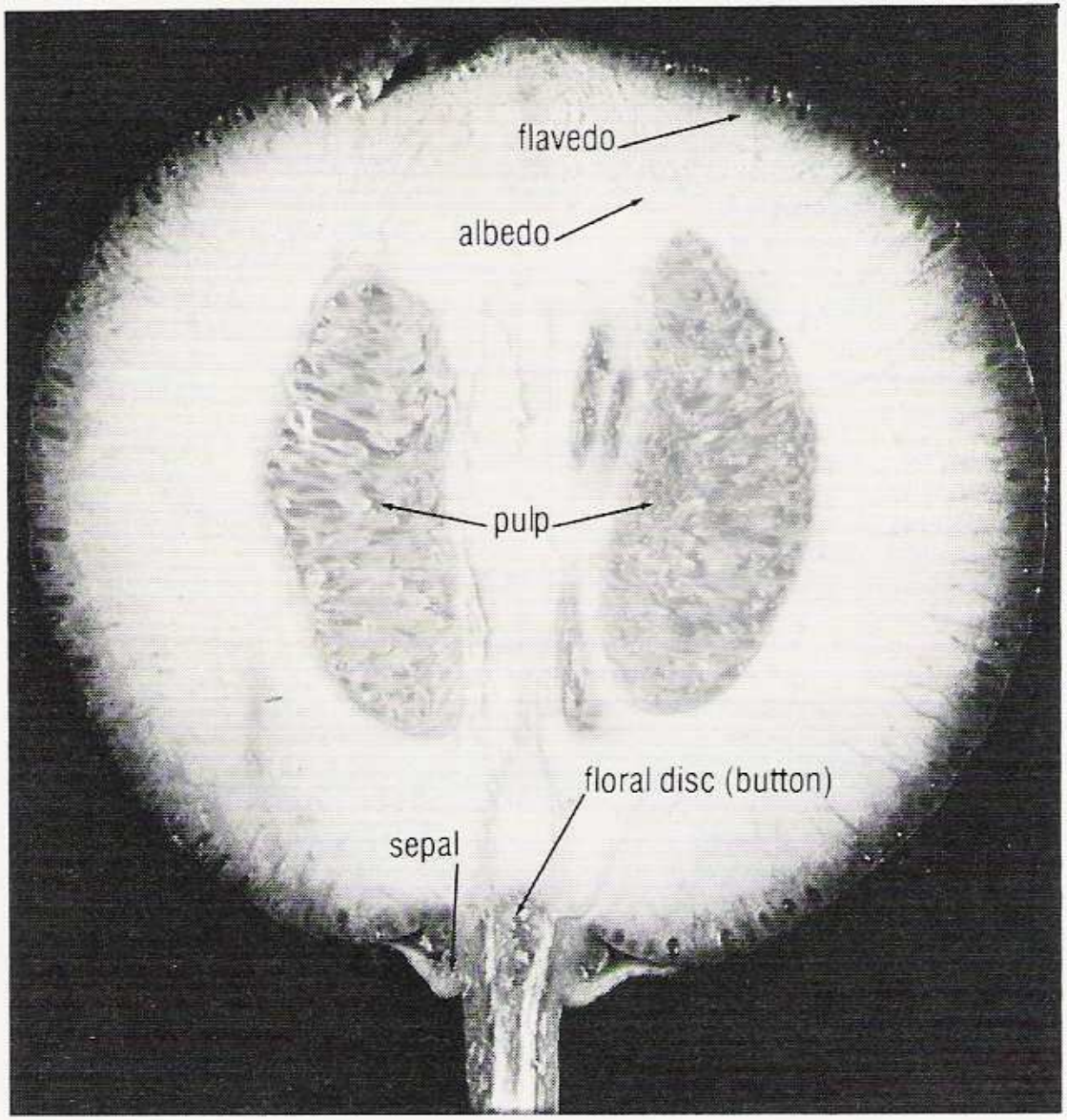


Figure 3. Section through a young navel orange. The rind consists of a thin, outer layer (flavedo), which contains pigments and oil cells, and a thick, white, spongy inner layer (albedo). The pulp, composed of juice vesicles, is just beginning to enlarge.

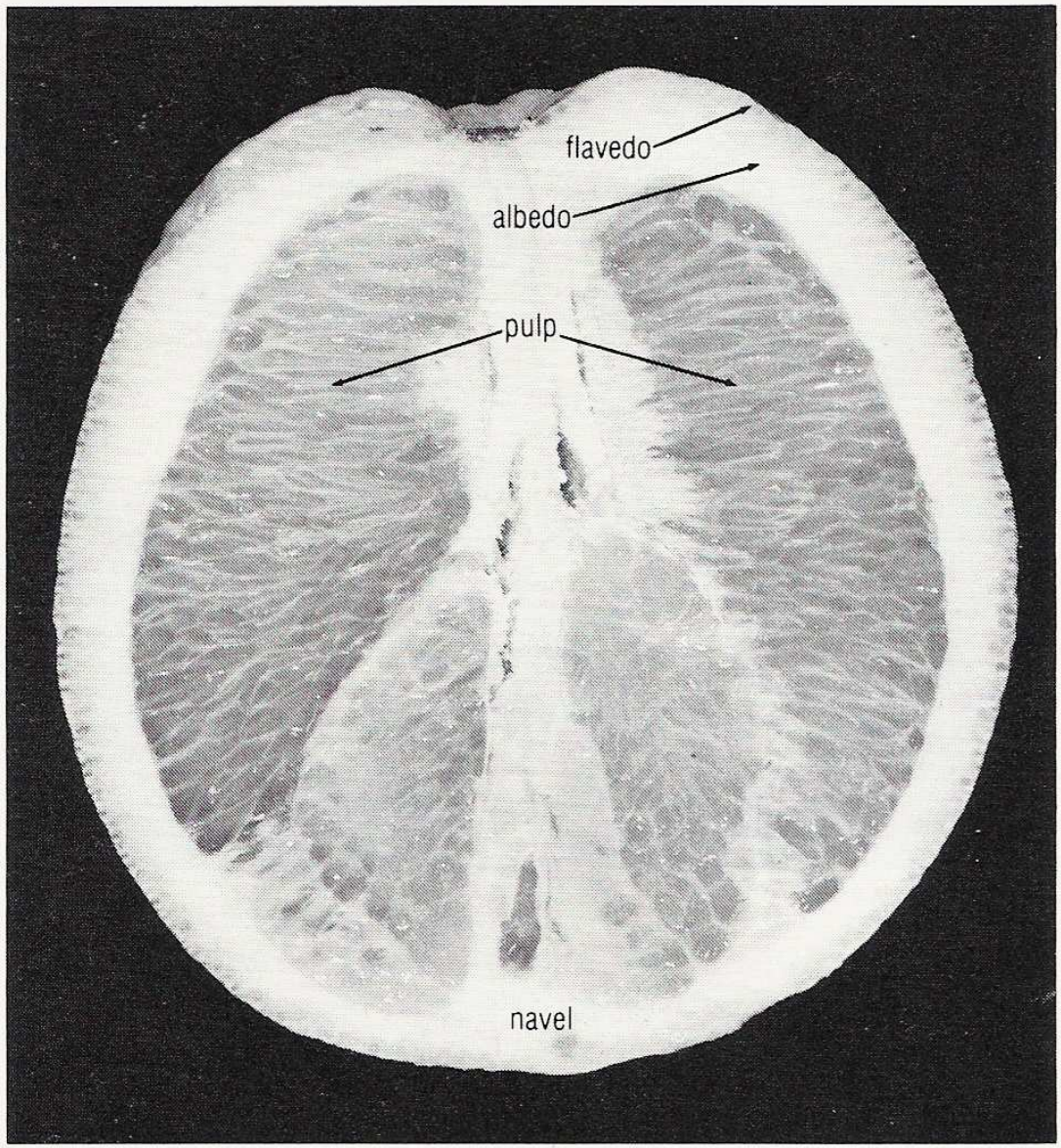


Figure 4. Section through a mature navel orange. The juice vesicles are now greatly enlarged and filled with juice of a certain acid/sugar ratio; the rind has become thinner as the fruit matured. The green pigments of the flavedo will have changed to bright orange if night temperatures have been low.

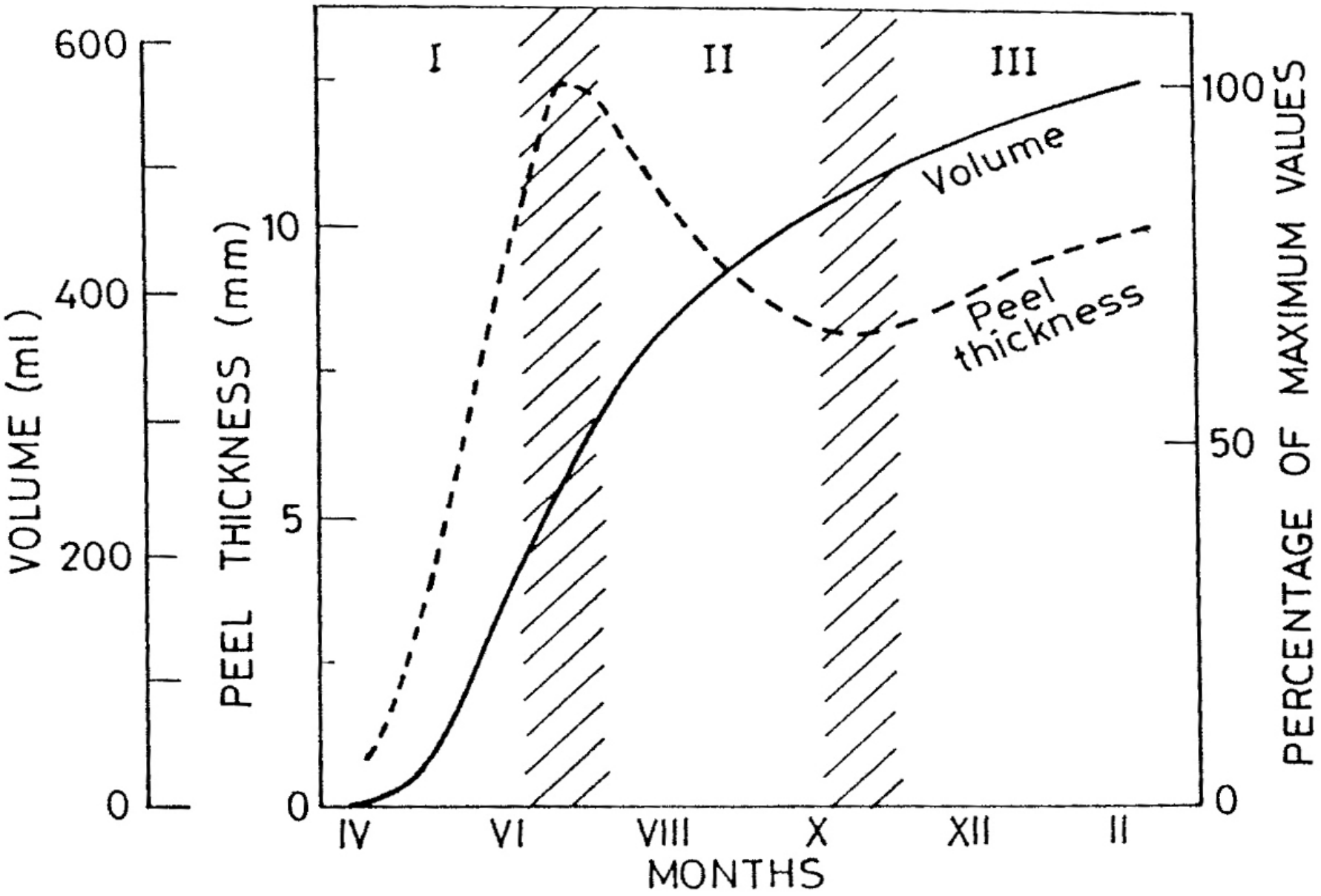


Figure 4.15 Fruit growth and development: growth in volume and peel thickness. I, II, III indicate developmental stages according to Bain (1958). Modified from Monselise (1986)

Fruit ripening

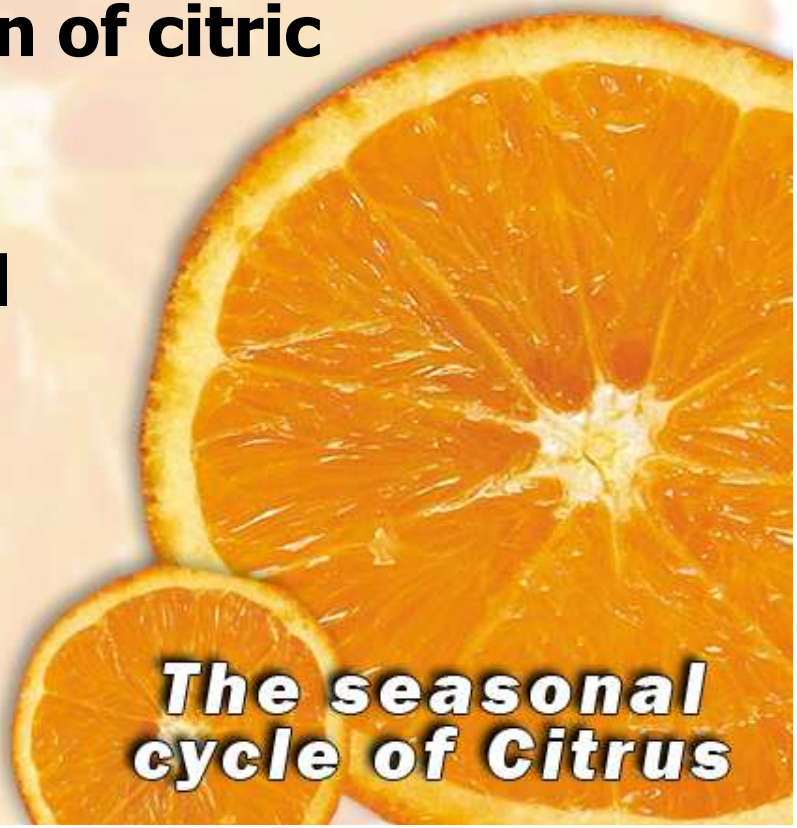
Juice increase

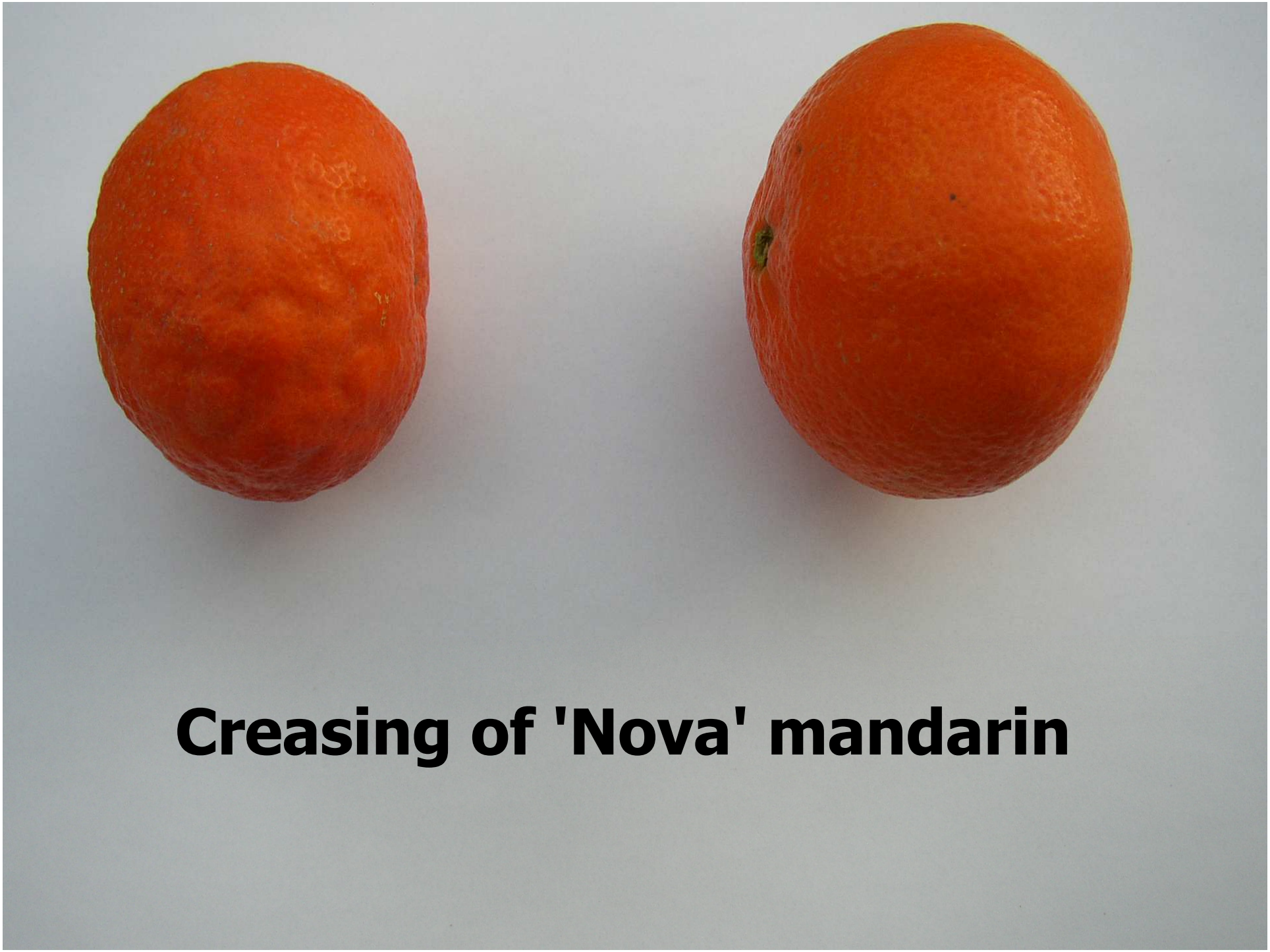
Sugars increase- expressed as total soluble solids

Acid decrease- decomposition of citric acid

Color changes- decline in rind chlorophyll

carotenoid accumulation

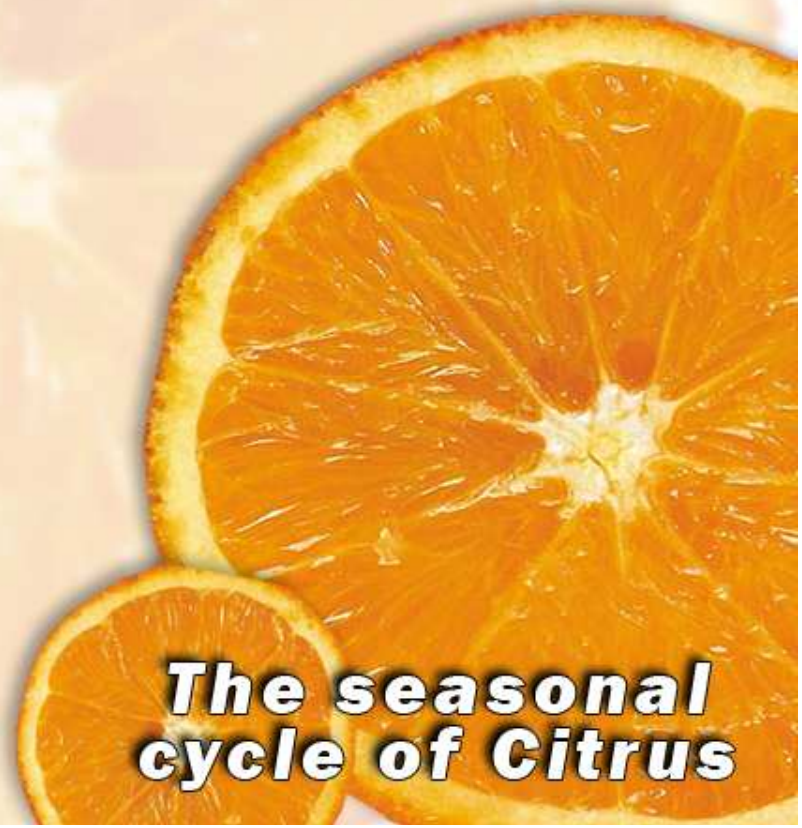




Creasing of 'Nova' mandarin

Fruit senescence (becomes old)

* color changes
* Fruit softening
* Fruit drop



Cultural practice,

Treatments for decreasing fruit drop and delaying rind senescence