HOS 4341
HOS 6932

Reproductive Growth
Maturation and Ripening

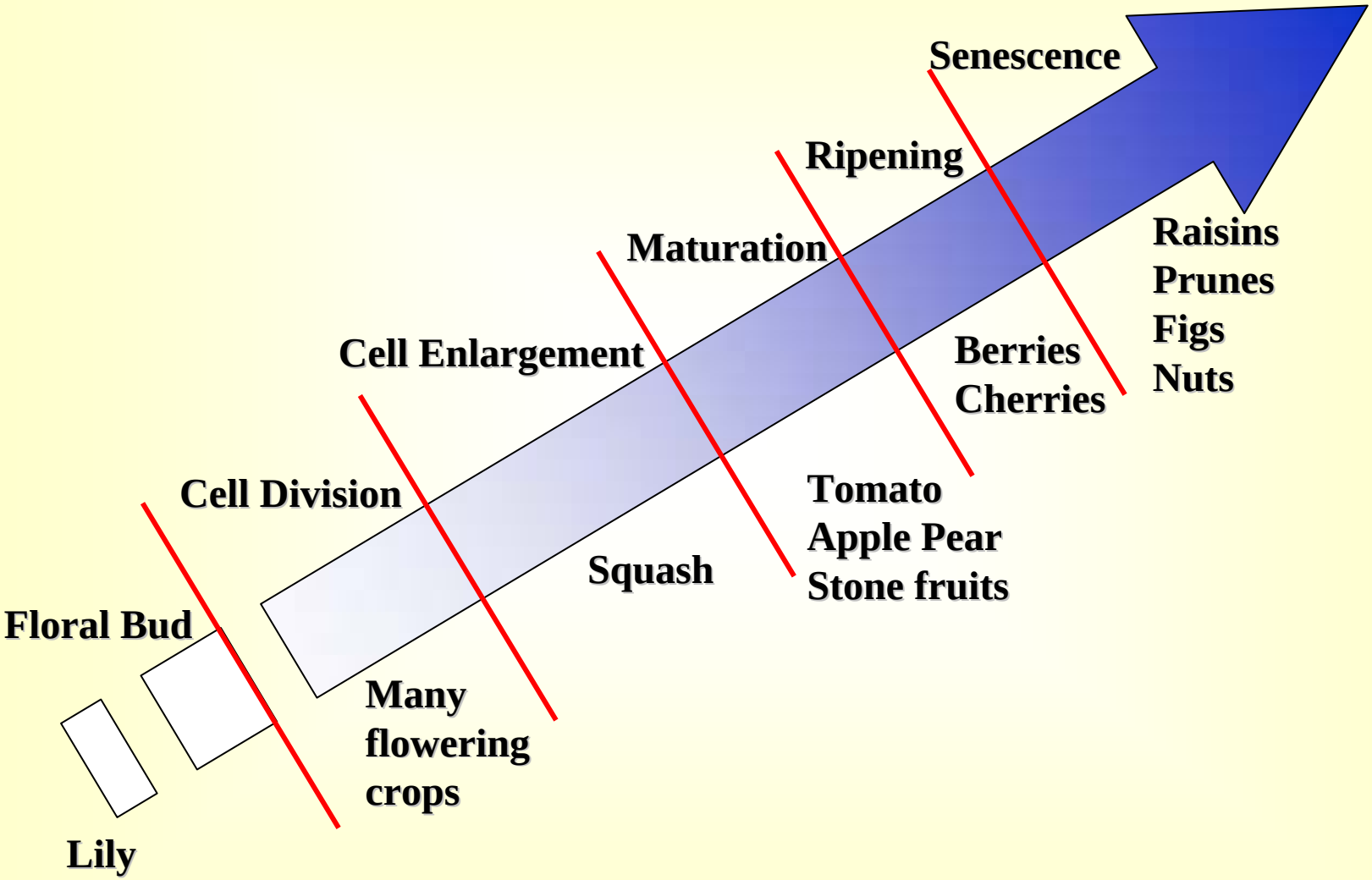
Maturation and Ripening

- **Maturation - time between final growth stage and beginning of ripening**

- **1. Physiological Maturity - attainment of full size - just beginning to ripen. Fruit can be removed at this stage and continue to ripen**

- **2. Horticultural Maturity - stage at which growth or development is optimum for a particular use i.e. a fruit that will become palatable after harvest**

Products at different stages of reproductive growth



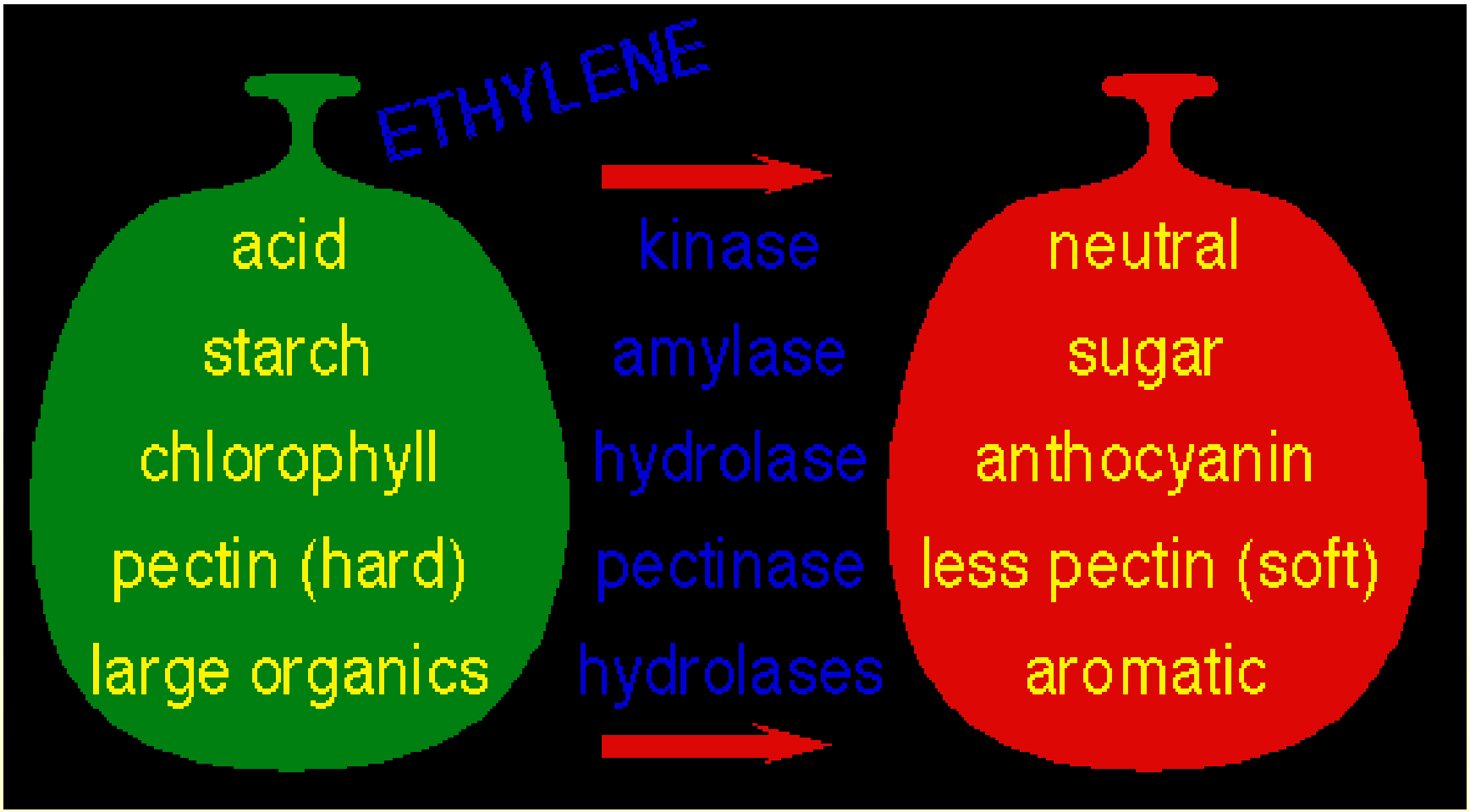
Ripening

Characteristic qualitative changes which occur after fruit has reached maturity

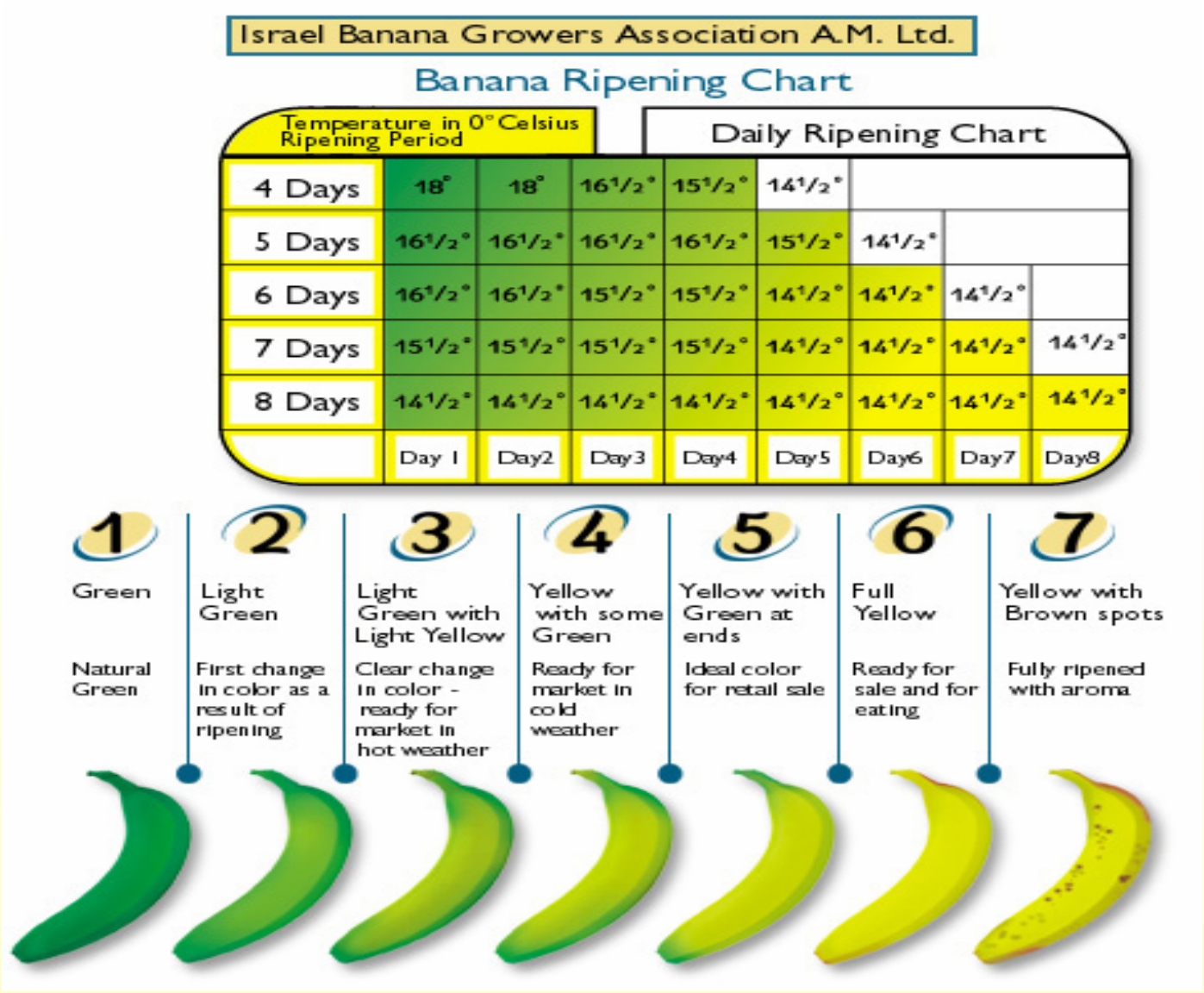
Changes:

- **1. Softening of fruit flesh - change in texture from firm to soft Function of cell wall dissolution**
- **2. Change in color - loss of chlorophyll, synthesis of yellow and red pigments - carotenoids (tomato, peach). Chloroplast --- chromoplast**
- **Anthocyanins (pink, red, purple - cherries, apples, blueberries)**
- **3. Change in aroma and flavor - aroma - alcoholic esters. e.g. amylacetate - ripe bananas. Flavors - sweetness - sugars, amino acids**
- **sourness**
- **Starch → sugar**
- **Decrease in acidity**

Ripening


ETHYLENE
acid
starch
chlorophyll
pectin (hard)
large organics
kinase
amylase
hydrolase
pectinase
hydrolases
neutral
sugar
anthocyanin
less pectin (soft)
aromatic

Manipulation of ripening with temperature



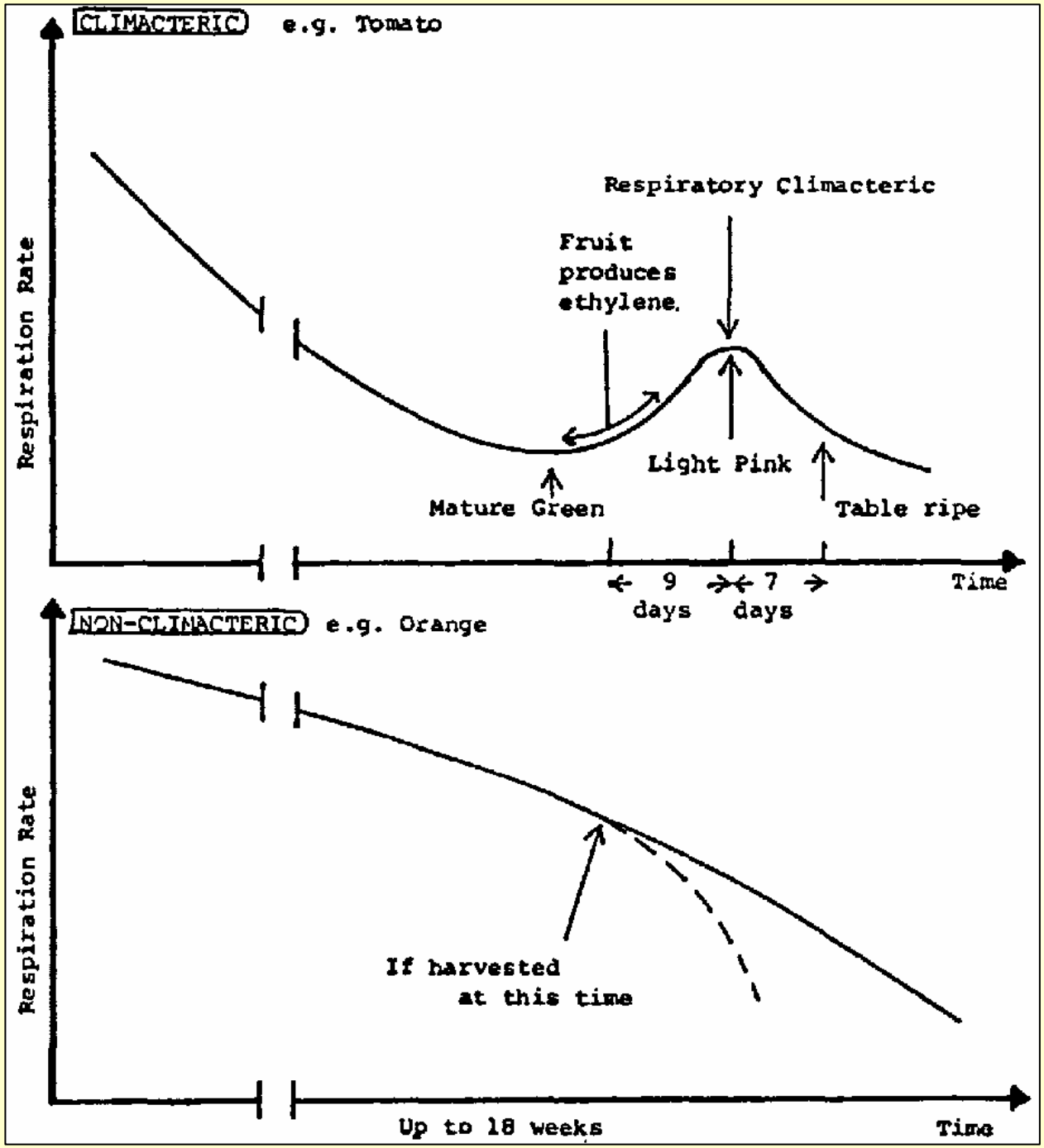
Ripening

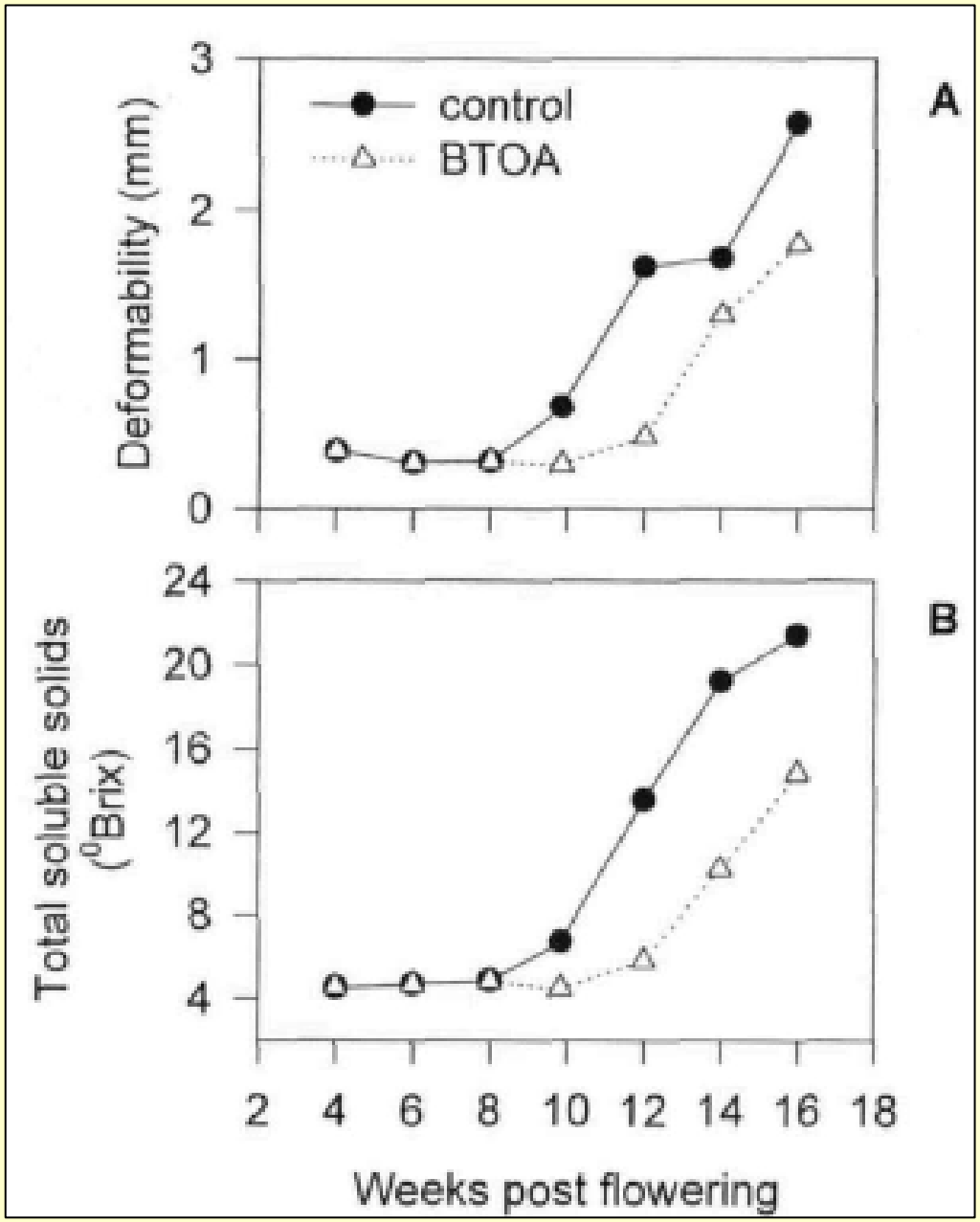
- Ethylene involved in ripening of some fruits
- Climacteric - e.g. tomato, apple, avocado, banana –
- Respiration increases at ripening.
- Associated with increase in C_2H_4 production
- Ethylene production in these fruits can be decreased via transformation with anti-sense ACC synthase or ACC oxidase. Significant delay in ripening. So, quantitative correlation between ethylene and ripening rate
- Non - climacteric - e.g. citrus, strawberries, grapes Don't exhibit increase in respiration or C_2H_4
- Activity of Alcohol dehydrogenase implicated
- Cannot manipulate ripening as clearly

Classification of edible fruits according to respiratory patterns.

Climacteric	Nonclimacteric
Apple	Blueberry
Apricot	Cacao
Avocado	Cherry
Banana	Cucumber
Breadfruit	Grape
Cherimoya	Grapefruit
Feijoa	Java plum
Fig	Lepsen
Guava	Litchi
Mammee apple	Melon
Mango	Olive
Muskmelon cantaloupe	Orange
Papaya	Pineapple
Passion Fruit	Rin-tomato
Papaw	Strawberry
Peach	Tamarillo
Pear	
PlumSapote	
Tomato	
Watermelon	

Respiration rates in climacteric vs. non-climacteric fruits





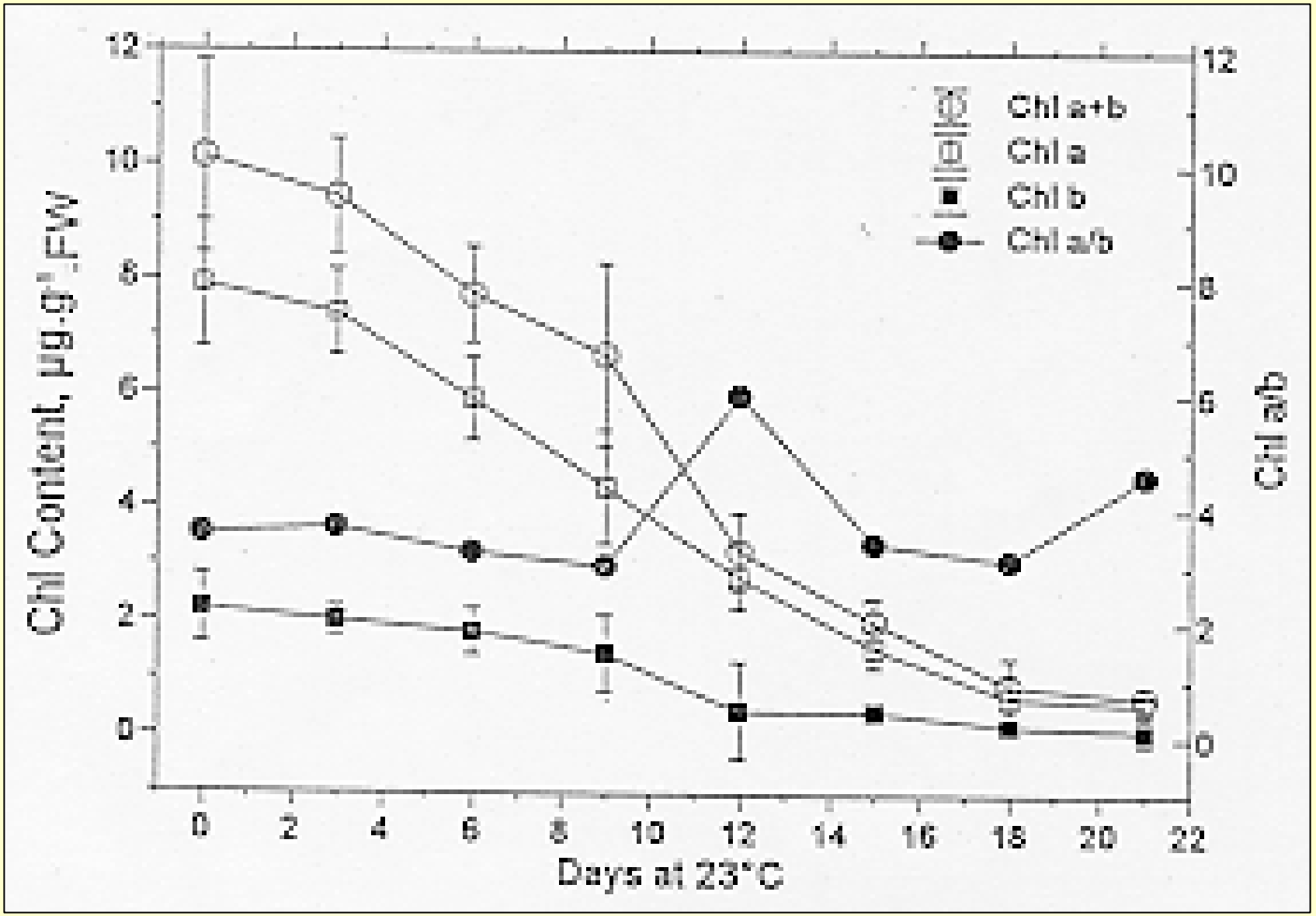
Delay of ripening in non-climacteric grape berries by application of synthetic auxin BTOA (benzothiazole-2-oxyacetic acid)

Mechanism of ripening in non-climacteric strawberry

- Combining the expression data from six different microarray experiments resulted in three major findings in relation to:
- (a) a novel yet uncharacterized ripening process in strawberry namely the development of the vascular system,
- (b) the association between ripening-related gene expression and oxidative stress response, and
- (c) hormone (auxin)-dependent and -independent processes.

Senescence

- Terminal, irreversible deterioration of tissue
- Partial - annual leaf and reproductive organ abscission
- Complete - annuals or biennials after reproduction
- - Aging process
- - Chlorophyll breakdown
- - N remobilized into perennial parts - 25 to 69% of N (protein, chlorophyll, amino acids) in leaves is remobilized. Much from Rubisco, which comprises 40% of leaf protein.
- - Photosynthesis and respiration decrease
- - Abscission layer forms



Decline in Chlorophyll concentration for 'Golden Delicious' apple fruit following removal from refrigerated air-storage for 2 months. Fruits were held in air at 23(C for 22 days. Each data point is an average of 5 samples.