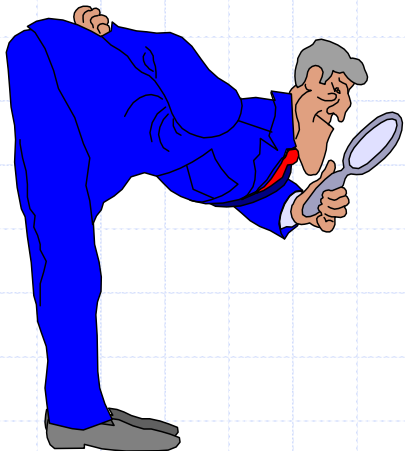


# Objective tests for determining quality and ripeness of fruit

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Anapa, Russia, October 2010



1. Taking the sample for the test
2. Determination of sugar content
3. Determination of fruit acids
4. Calculation of sugar/acid ratio
5. Determination of dry matter content
6. Determination of starch content
7. Determination of firmness
8. Determination of juice content
9. Determination of skin colour

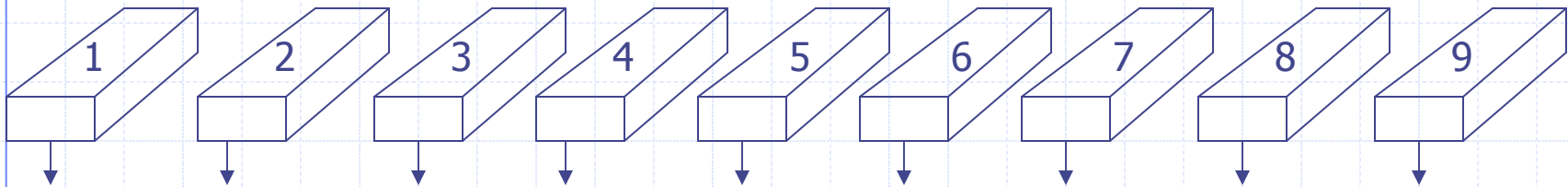
# 1. Taking the sample

- ◆ Checks on maturity and ripening are carried out on the basis of reduced samples.
- ◆ Controls that destroy the produce should not exceed 10 % of bulk sample.

# Apple example

- ◆ Consignment with 500 boxes
- ◆ 12 kilos in each box

Bulk sample consists of 9 primary samples  
(9 boxes, 30 fruits from each box)



Reduced sample consists of no more than 3 apples from  
each box



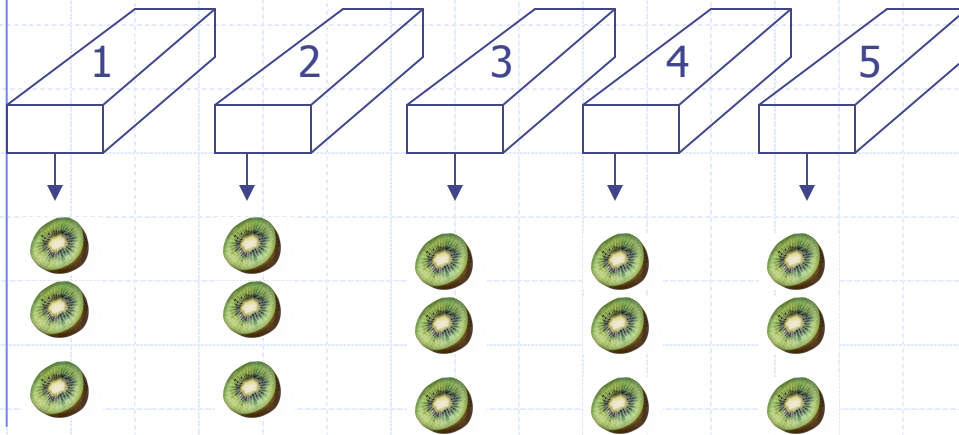
For tests – take at least 10 apples from the reduced sample

## Example kiwi fruit in consumer packages

- 50 boxes; sender, variety and size are the same
- 12 packages of 1 kilo in each box
- 15 – 18 fruit in each package

## Bulk sample consists of 5 primary samples

(5 boxes out of which 3 consumer packages are taken from each box)



Suggestion for reduced sample:

Take 1 kiwifruit out of each of the  
3 consumer packages selected from each box

For tests – take at least 10 kiwifruits from the reduced sample

## 2. Determination of sugar/ total soluble solids (tss)

- ◆ Sugar/ tss is determined with refractometer
- ◆ The reading for each fruit is recorded and the average taken from the total of all samples



# Handheld manual refractometer

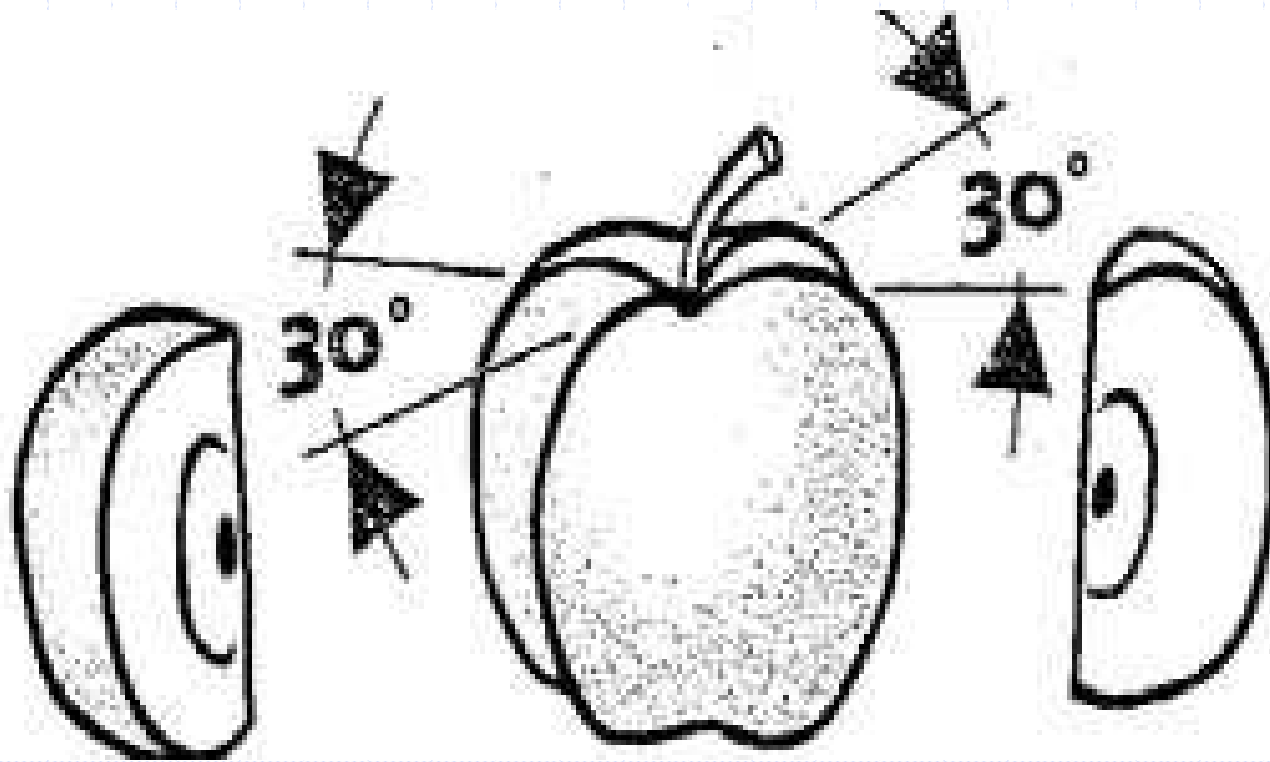


# Digital refractometer



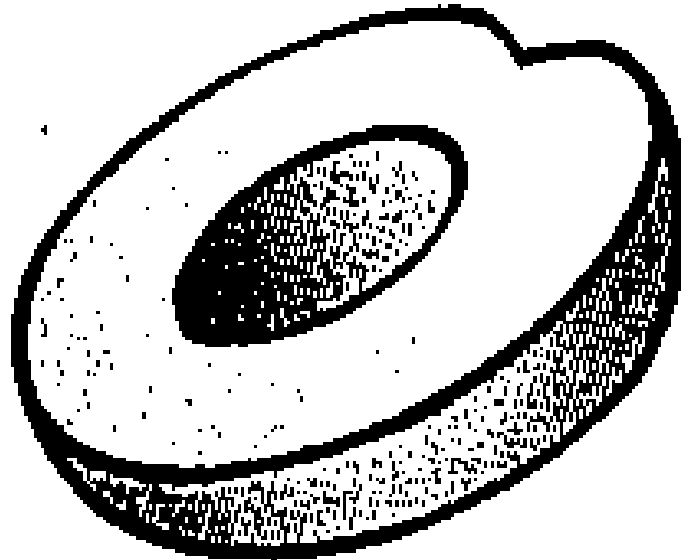
# Apple samples (& pears, peaches, nectarines)

Squeeze the juice out of two slices, one from the red side and one from the green side (in relevant cases).



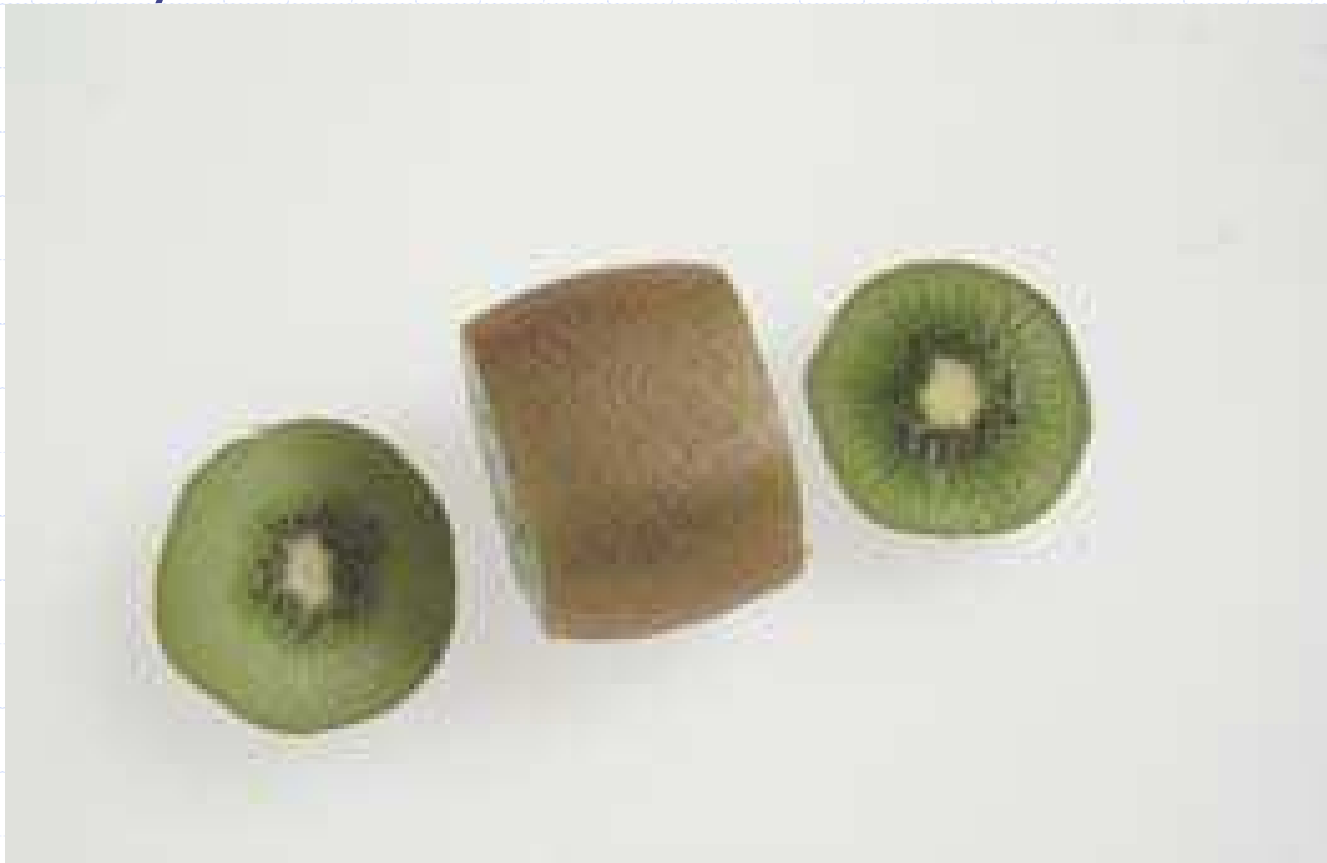
# Plum and apricot samples

Cut the fruit in half. Each half is measured to get a mixture of juice from all regions.

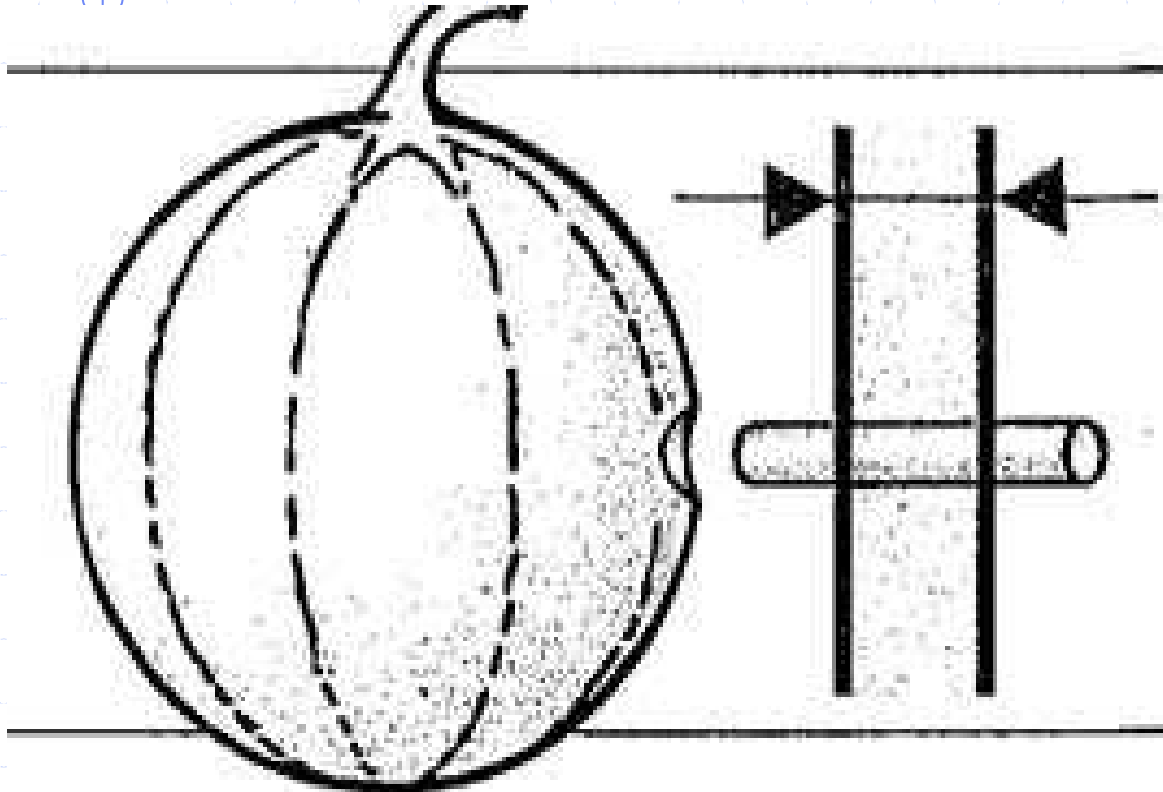


# Kiwifruit samples

Cut the stem and blossom ends at a distance of 15 mm from each end of the fruit and squeeze the two slices separately.

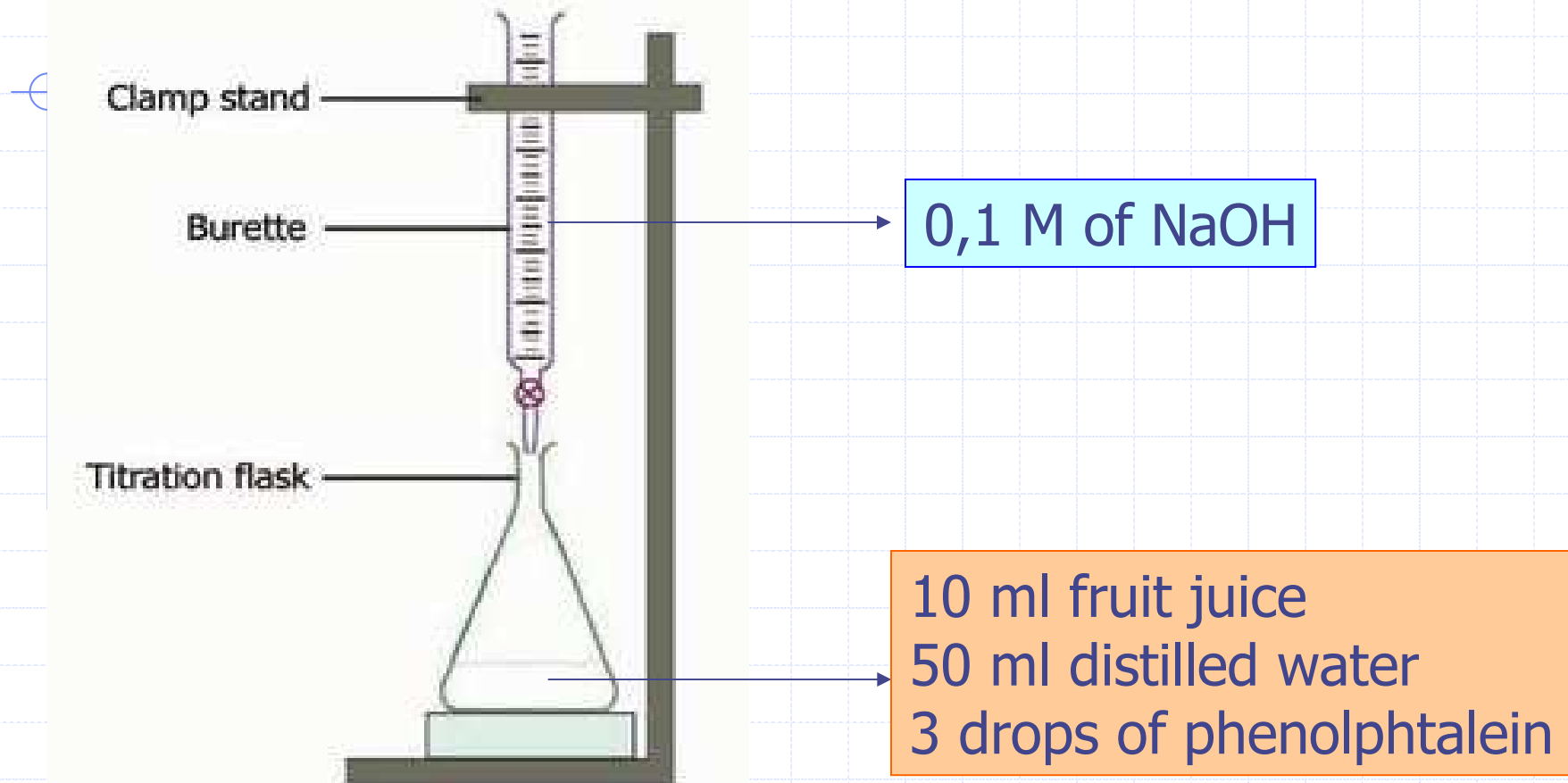


# Melon samples



Using a small diameter metal borer (1 – 4 mm) a core of melon should be extracted from the equatorial axis area. Each end of the core should be discarded. The remaining flesh should be used to extract the juice for testing.

### 3. Determination of fruit acids by manual titration



Drop NaOH (titre) into the titration flask until the colour changes (pH 8,1)

Note the number of ml used (titre volume)



## Preparation of juice extracts for titration to determine acid content





## 3+4. Calculation of acid content and of sugar/acid ratio

### ◆ Percentage citric acid

- ml titre x 0,064

### ◆ Sugar/acid ratio

Brix value

Percentage citric acid

### ◆ Citric acid in gram /litre

- Ml titre x 0.64

### ◆ Sugar/acid ratio

Brix value x 10

g/l citric acid

Factors for.  
Citric acid (citrus fruit)  
0.064

Malic acid (apples)  
0.067

Tartaric acid (grapes)  
0.075

# 5. Determination of dry matter content

## ◆ Using a laboratory oven

- Weigh sample (A)
- Dry 24 hrs in 70 degrees (can be followed by 1 hr in 105 degrees)
- Cool in desiccator
- Weigh sample (B)
- Dry weight is  $(A/B) \times 100$

## ◆ Using a microwave

- Dry at max effect for 4-7 minutes (until constant weight)
- Weigh without cooling
- Calculate as above

## 6. Determination of starch content in apples and pears

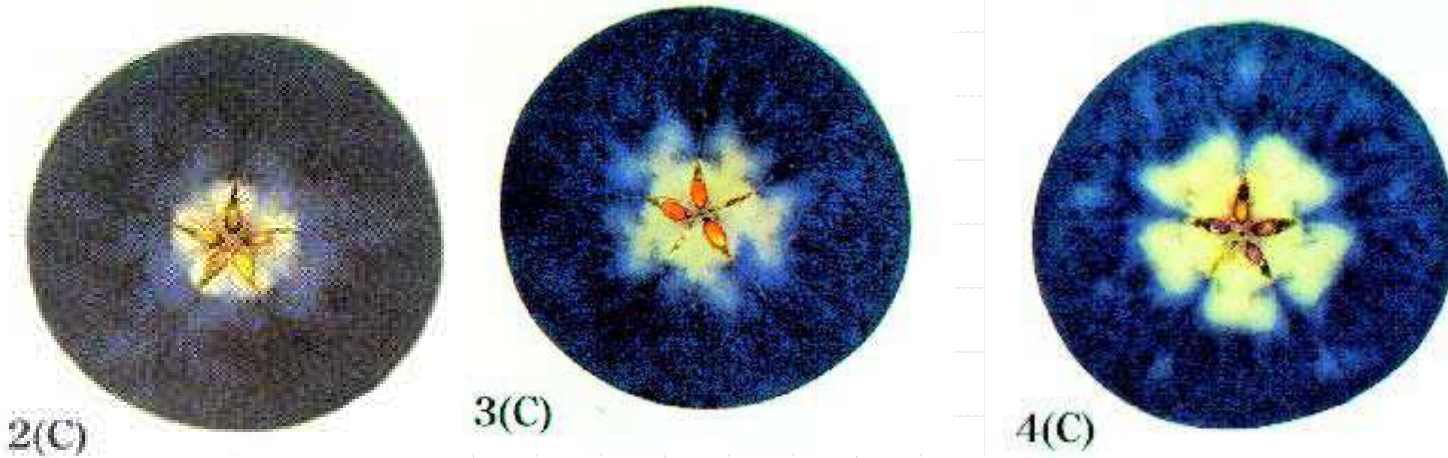
- ◆ Cut the fruit in half (an equatorial cut)
- ◆ Immediately coat the cut surface with iodine solution
- ◆ Leave for 1 minute and record the result
- ◆ Starch value goes from 0 (immature) to 10 (fully ripe)
  
- ◆ Starch is stained dark violet by iodine
- ◆ In more mature fruit there is less starch and hence less violet on the tested fruit

# Slight central discoloration (immature fruit)



1 (C)

# Central discoloration

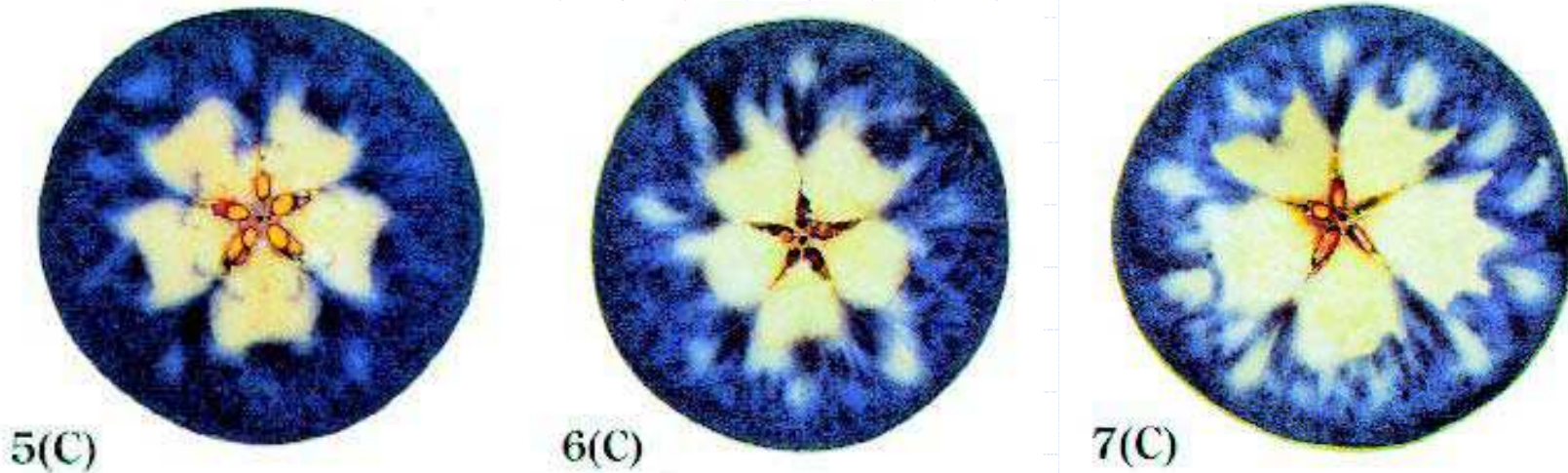


Increasing maturity



Increasing areas of yellow where the starch has been broken down to sugar

# Increasing central discolouration with peripheral spots



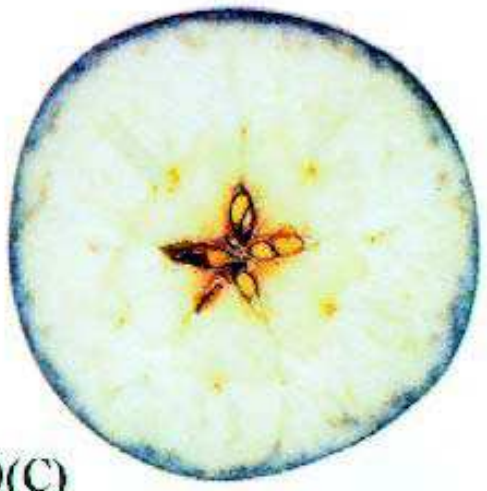
Increasing maturity



Increasing areas of yellow where the starch has been broken down to sugar



# Increasing peripheral discolouration (fully ripe fruit)



Increasing maturity



Increasing areas of yellow where the starch has been broken down to sugar

# 7. Determination of firmness

- ◆ Firmness is established by using a penetrometer





# Measuring firmness

- ◆ Peel off the skin on opposite sides of the fruit (sun and shade side)
- ◆ Press the plunger into the flesh (it should take 2 seconds, count 1001)
- ◆ Read the firmness value off the penetrometer

## Starch value, firmness and sugar content in Swedish apple variety Aroma at different harvest dates

Harvest date	Starch value (0-9)	Firmness (kg/cm <sup>2</sup> )	Sugar content %
Aug 25-31	0.7	8.0	10.6
Sep 1-6	1.0	8.0	11.6
Sep 7-13	2.3	7.3	12.3
Sep 14-20	3.3	7.4	12.0
Sep 21-27	5.0	6.6	13.3
Sep 28-Oct 4	6.3	6.2	13.0
Oct 4-10	7.7	5.8	13.1

## 8. Determination of juice content in citrus fruit

- ◆ Determine total weight of fruit
- ◆ Cut fruit in half (equatorial cut)
- ◆ Extract all juice with an extractor or juice press
- ◆ Filter the extracted juice through muslin cloth, fine filter or strainer
- ◆ Weigh the extracted juice



# Determination of juice content in citrus fruit (1) weighing





# Determination of juice content in citrus fruit, (2) extraction



# Calculation of % juice content

$$\frac{\text{Total weight of juice (g)}}{\text{Total weight of fruit (g)}} \times 100$$

## 9. Determination of skin colour

- ◆ Colour gauges
- ◆ Colourimeter (gives a "hue value")



# Determination of colour with colour gauges



Thank you for your  
attention

