Module 12
Maturity Indexing

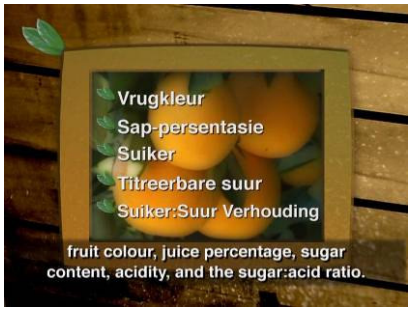
Presenter: Stephan Verreynne

Introduction

Maturity indexing is used to predict the optimum picking time for citrus fruit. This information, together with yield and fruit size estimates, are used to plan for harvesting and are sent to the packhouse to assist with their planning.

To be able to estimate when the fruit in a certain orchard or block will be ready for harvesting, we measure and plot over a period of time the maturity parameters of a sample of fruit taken from that block.

Maturity Parameters



It is also important to make sure that export fruit meets the minimum maturity standards of the market it is intended for, and that it is not picked before those parameters are reached. Different markets have different maturity parameters, and the producer must always ensure that he is well informed of the minimum requirements for his target markets. There are various parameters that are used to determine the maturity and harvest time of citrus. These are:

- Fruit colour
- Juice percentage
- Sugar content
- Acidity
- Sugar : acid ratio

Fruit Colour

Fruit colour is measured against a colour chart. Different charts are used for the various types of citrus.

information

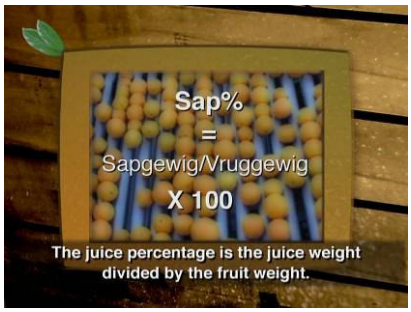
Colour Charts

Colour charts are available from the CRI (Citrus Research International), at (013) 759-8000 or www.cri.co.za. For more information on how colour charts are used, please view modules 26 and 28.

Juice Percentage

Juice percentage is determined by weighing a sample of twelve fruit. The juice is then extracted from the fruit, filtered through a cheese cloth, and weighed.

The juice percentage is the juice weight divided by the fruit weight.



skills

Please see the skills sheet on **Determining Juice Percentage**.

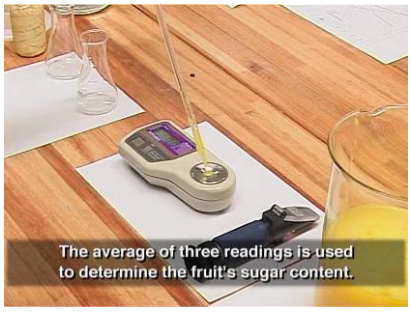
example

Juice Percentage

Whole fruit weight – 1,300g
Juice weight – 570g
Juice percentage = juice weight / whole fruit weight x 100
= 570g / 1,300g x 100
= 43.85%

Sugar Content

Sugar content is measured with a refractometer. The refractometer is set to zero with distilled water before measuring. The average of three readings is used to determine the sugar content.



skills

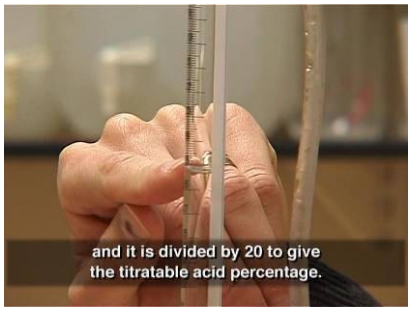
Please see the skills sheet on **Determining Sugar Content (TSS%)**.

Titratable Acid

Acid, or titratable acid, is measured by titration. We measure mainly citric acid, which is 70 to 90% of the acid in the sample.

Usually we take 20ml well-mixed juice, add 5 drops of phenolphthalein as indicator, and titrate with a 0.1562 normal sodium hydroxide solution, until the mixture turns pink.

The volume of sodium hydroxide in millilitre used in the titration is then read, and is divided by 20 to give the titratable acid percentage.



information

Titration

More on information on the principals of titration can be found in module 21 – Titration.

skills

Please see the skills sheet on **Determining Titratable Acid Content**.

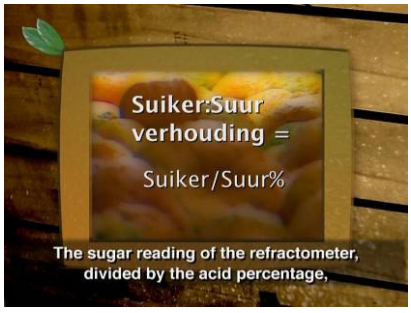
example

Titratable Acid

Titration reading – 30ml
Acid percentage = 30 / 20 x 100
= 1.5%

Sugar : Acid Ratio

The sugar reading from the refractometer is divided by the acid percentage, to give us the sugar : acid ratio.



example

Sugar : Acid Ratio

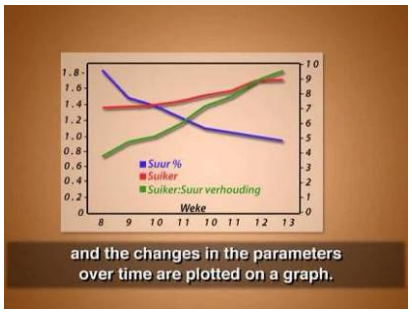
Sugar content – 8.5
Acid percentage – 1.5%
Sugar : acid ratio = 8.5 / 1.5
= 5.7

Maturity Indexing

Maturity indexing is necessary to determine the tempo of change in maturity parameters, to predict the optimum picking time and to know when picking should finish. The second reason for maturity indexing is to ensure that harvested fruit meets minimum export standards.

Maturity indexing is done by picking a sample from a uniform block or unit, with trees of the same age, cultivar and rootstock.

Sampling is done weekly, from four to six weeks before the predicted harvest time. Twelve representative index trees are chosen and one fruit per tree, from similar positions on the trees and of similar size, are picked to make up the sample.



The parameters of the sample fruit are determined, and the changes in the parameters over time are plotted on a graph. Minimum and maximum standards can be added to the graph. Trends will become evident on the graph. The picking date can now be predicted and problem areas can be identified.

information

Index Trees

To build accurate historical data, it is important to measure and test the fruit of the same index trees at the same time every year.

active learning

Watch the DVD clips, read through the learning material and do workplace research to gather the knowledge and information to complete the assignments below.

Activity 12.1 – Workplace Interview

Ask a workplace expert or your supervisor to explain to you step-by-step how maturity indexing is done on your farm.

Compare this procedure to the procedure described in this module, and other information that you can find, and identify any shortcomings.

Activity 12.2 – Workplace Practical

Ask the person responsible for doing internal quality tests on the fruit from your farm or in your packhouse, to show you how to do the tests, and then perform the tests on your own. Compare your results to the expert's and explain any differences.

Activity 12.1 – Workplace Interview

Ask a workplace expert or your supervisor to explain to you step-by-step how maturity indexing is done on your farm.

Compare this procedure to the procedure described in this module, and other information that you can find, and identify any shortcomings.

Details of interviewee	
Name and surname:	
Date of interview:	
Signature of interviewee:	

Activity 12.2 – Workplace Practical

Ask the person responsible for doing internal quality tests on the fruit from your farm or in your packhouse, to show you how to do the tests, and then perform the tests on your own.

Tools and equipment	*Handling before, during and after task completion*

SOPs:

Day	*Details of tasks completed*	*Time spent on tasks*	*Signature of supervisor*

Compare your results to the expert's and explain any differences.

Determining Juice Percentage

Requirements

- ☐ **Scale** (weighing up to 5kg, graduated in 1g units)
- ☐ **Sharp knife**
- ☐ **Juice extractor** (hand reamer, machine, juice press for soft citrus)
- ☐ **Muslin or parachute cloth**
- ☐ **2 x Wide-mouth enamel jugs** (1 litre capacity)

Method

1. **Select a sample of twelve fruit**
2. **Weigh fruit and note weight in grams**
3. **Cut each fruit in half at its equator**
4. **Extract juice thoroughly, using hand reamer or suitable machine – for soft citrus, peel fruit and use a juice press**
5. **Keep fruit rest (peel and rag) in one jug**
6. **Strain juice through two thicknesses of muslin cloth or one thickness of parachute cloth into other enamel jug – gather edges of cloth in one hand and squeeze bag of juice and fruit rag to speed up straining, continue squeezing until remaining rag is not soggy but just damp (twisting bag into ball can assist process), squeezing should take about four minutes**
7. **Place fruit rests (rag and seeds) remaining in cloth with other fruit rests**
8. **Weigh fruit rests and note weight in grams**
9. **Calculate the juice percentage:**

$$\text{Juice \%} = \frac{\text{(whole fruit weight)} - \text{(fruit rests weight)}}{\text{(whole fruit weight)}} \times 100$$

ALTERNATIVELY

7. **Weigh extracted juice and note weight in grams**
8. **Calculate the juice percentage:**

$$\text{Juice \%} = \frac{\text{(juice weight)}}{\text{(whole fruit weight)}} \times 100$$

Determining Sugar Content (Total Soluble Solid %)

Requirements

- ☐ **Brix refractometer** (range 6 to 12% total soluble solids, graduated in tenths of a percent, standardised at 20ºC)
- ☐ **Brix refractometer** (range 11 to 17% total soluble solids, graduated in tenths of a percent, standardised at 20ºC)

Method

1. **Mix juice sample well**

Hand-held Refractometer

2. **Put one or two drops of sample on prism**
3. **Close daylight plate gently**
4. **Sample must spread all over prism surface**
5. **Look at scale through eyepiece**
6. **Read scale where the boundary line intercepts it**
7. **Wipe clean sample from prism with a tissue paper**

Pocket Refractometer

2. **Clean the prism surface**
3. **Place approximately 0.3 ml of sample onto prism surface**
4. **Press START key**
5. **Measurement value will be displayed on screen after arrow blinks 3 times**
6. **Measurement value will remain displayed for approximately one minute**
7. **To turn off display, press and hold down START key for approx 2 seconds**
8. **Remove sample by wiping it off with tissue**
9. **Use water to remove any remaining sample, dry off excess moisture with clean, dry tissue**

Determining Titratable Acid Content

Requirements

- ☐ **Erlenmeyer flask** (200ml capacity)
- ☐ **Dropper bottle** (50ml capacity)
- ☐ **Phenolphthalein indicator solution**
- ☐ **Burette** (50ml capacity, graduated in tenths)
- ☐ **Burette stand**
- ☐ **Sodium hydroxide (H_2SO_4) solution (0,1562 Normal (N))**

Method

1. **Mix juice sample well**
2. **Transfer 20ml juice to Erlenmeyer flask**
3. **Add five drops of phenolphthalein indicator with dropper bottle**
4. **Titrate with 0,1562 N sodium hydroxide from 50ml burette**
5. **Use white tile or white paper under Erlenmeyer flask to see the endpoint more clearly**
6. **Contents of Erlenmeyer should be constantly mixed during titration**
7. **When endpoint is approached, solution in Erlenmeyer shows streak of pink arising from the point where sodium hydroxide enters juice**
8. **Continue adding sodium hydroxide drop by drop**
9. **Endpoint is reached when pink colour persists throughout solution for at least five seconds after last addition of sodium hydroxide from burette**
10. **Read the contents of burette at bottom of meniscus**
11. **Calculate acid percentage by dividing millilitres titrated by 20**