

# Basic Laboratory Analysis of Fruit for Cider Making

Cider Apple Production in  
Vermont: Market  
Opportunities and Technical  
Challenges

March 30, 2015

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Vermont Hard Cider Co.

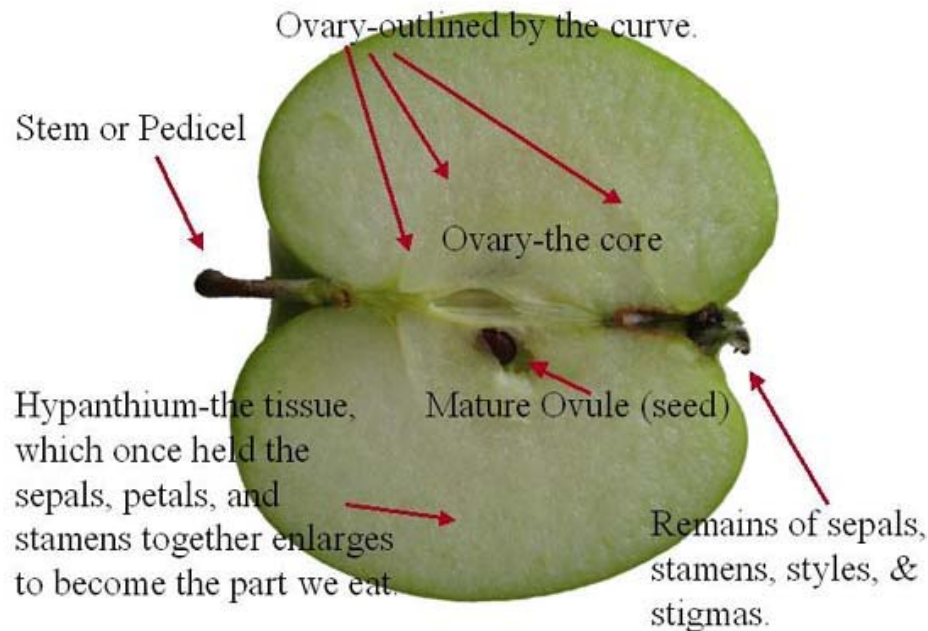
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# Components of Apples & Cider

## APPLE COMPONENTS



\*Viney M. (2007). The Virtual Apple Parer Museum  
<http://appleparermuseum.com>

## CIDER COMPONENTS

**Apple Juice** – 90% Water and 10% Solids

**Sugars** – 80% of total soluble solids

**Acids** – Mainly Malic Acid, plus some other organic acids

**Nitrogen** – Ranging from 40-350 ppm, mostly amino acids

**Tannins** – Phenolic compounds associated with astringency and bitterness. Low in desert apples, higher in bitter varieties

**Aromas & Flavors** – Varietal specific

**Vitamins & Minerals** – B-vit, plus some mineral salts

**Starch** – Accumulated early, then converted to sugars

**Pectin** – Affects pressing & filtration

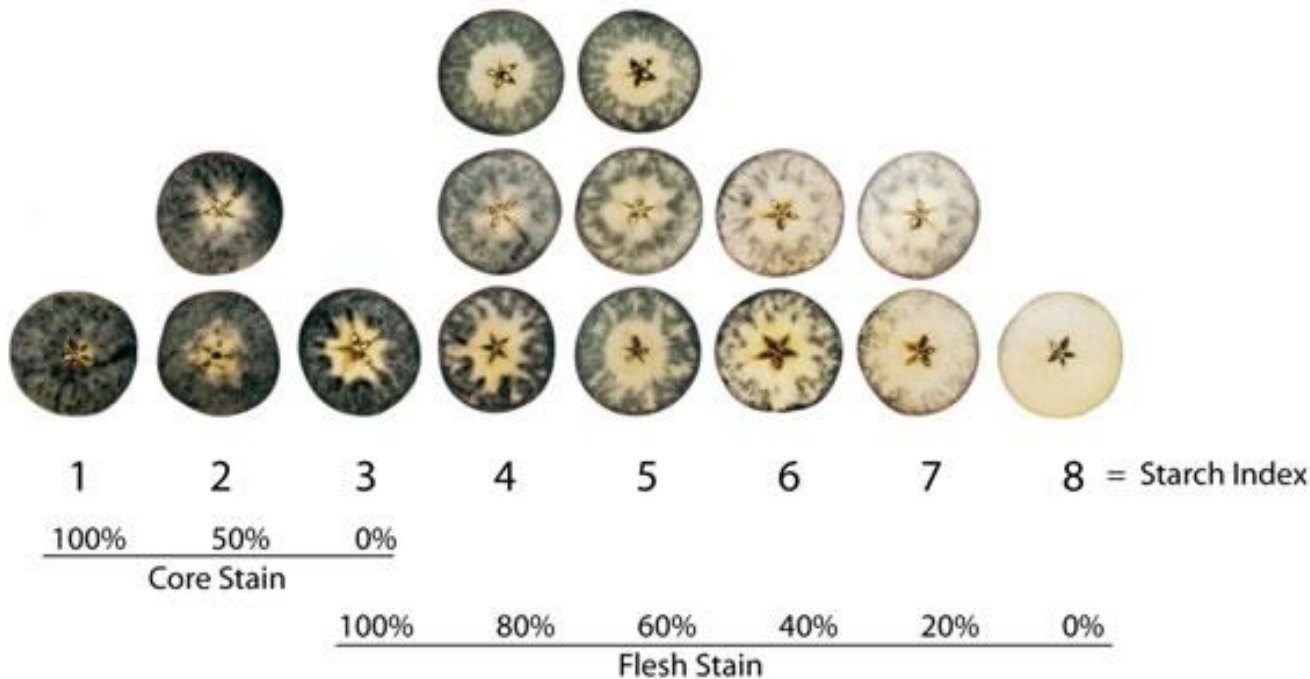
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# Starch-Iodine Index

Cornell starch-iodine starch staining pattern



\*Blanpied and Silsby (1992)

## STARCH-IODINE INDEX PROCEDURE

- Use a fresh iodine solution
- Pick 10 representative apples
- Cut in half through the equator
- Dip half of the apple into solution
- Wait 1 minute for starch patterns to develop
- Arrange apples in order from darkest to lightest
- Compare to patterns with picture to approximate S-I Index
- Calculate an average index number.
- Example when McIntosh changes from 60-40% stain (5 to 6) it is ready to be picked.
- Varies by Variety – Empire 4.5-5.5, Idared 2.8-3.5

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# Firmness

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## FIRMNESS TESTING PROCEDURE with a PENETROMETER

- A measure of ripeness and condition
- Use plunger with 7/16-inch (smaller one used for pears)
- Calibrate with accurate scale
- Collect representative sample of 10 apples of similar diameter
- Slice cheek of apple (green and blush sides)
- Push until line on plunger is level with outer flesh (2 seconds)
- Read gauge in lbf or N
- Take 2-3 tests per apple
- Sources of Error
  - Wide variation (3-4 lbs by professional users)
  - Nitrogen levels
  - Water Core
  - Water loss

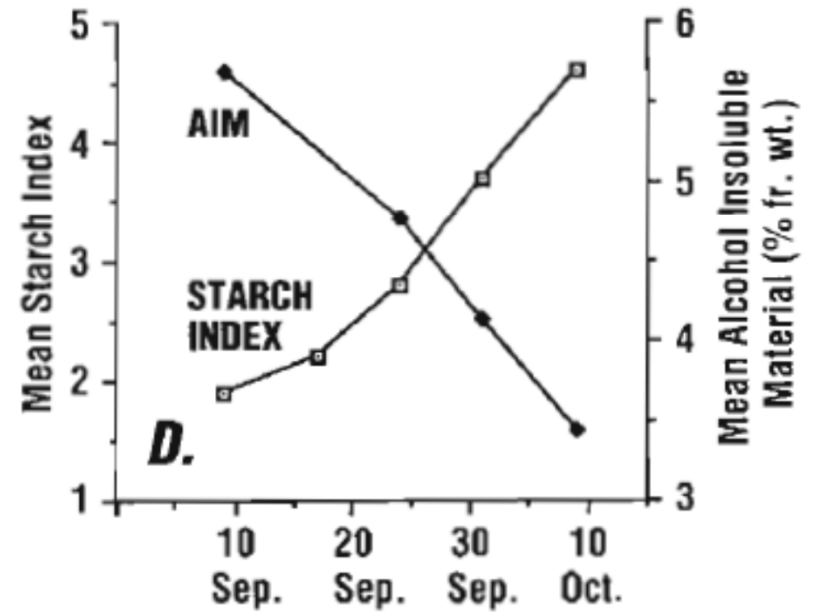
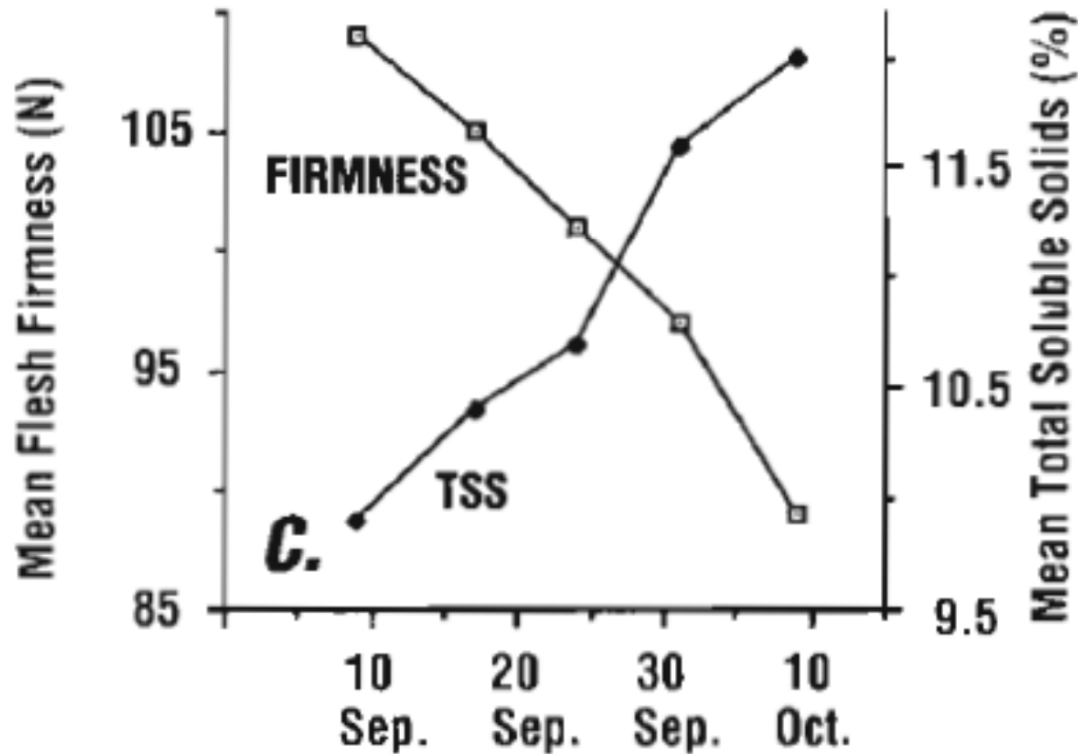
\*Blanpied (1977)

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# Harvest for Eating or Harvest for Cider Making?



\*Blanpied and Silsby (1992)

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# Ideal Cider Chemistry?

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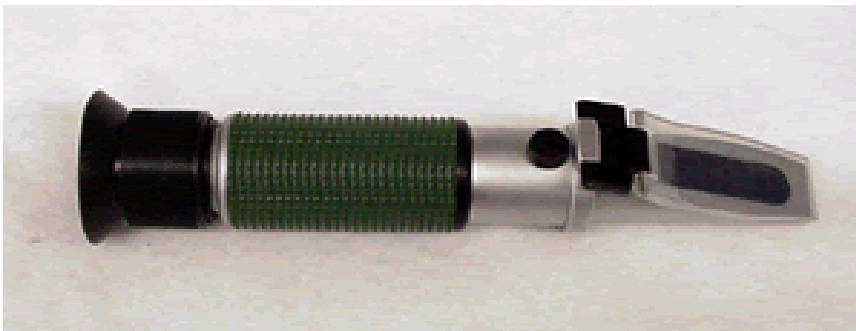
## Depends on Style

- High Fermentable Sugars – 11 to 15 Brix
- Good Acidity – 5-6 g/L T.A. as malic acid
- Stable pH – 3.3-3.7 (above 3.8, cider becomes unstable)
- Tannin – none to plus 2 g/L
- Nitrogen 75 mg/L to 150 mg/L
- Thiamine >0.2 mg/L
- Pantothenate >0.2 mg/L

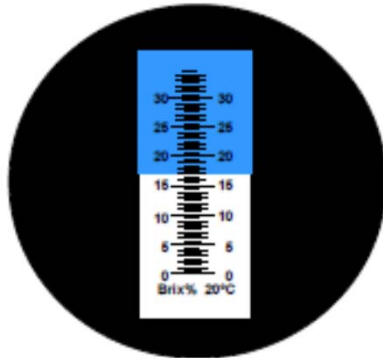


# Sugars – Refractometer & Hydrometer

## BRIX HAND REFRACTOMETER



- Calibrate at room temperature
- Juice a representative sample of apples
- Deposit juice sample onto prism
- Correct for temp.



\*Vasquez and Mueller (<http://ucanr.org/sites/viticulture-fresno/files/115503.pdf>)

## BRIX HYDROMETER

- Put 220 mL juice in 250 mL cylinder
- Suspend hydrometer in sample and gently spin to read measurement
- Measure sample at 68°F or correct for temperature
- CO<sub>2</sub> can interfere with sample. De-gas if necessary

\*Gusmer Enterprises  
(<http://www.gusmerenterprises.com/pdf/Procedures/Brix%20Hydrometer%20and%20Refractometer081808.pdf>)



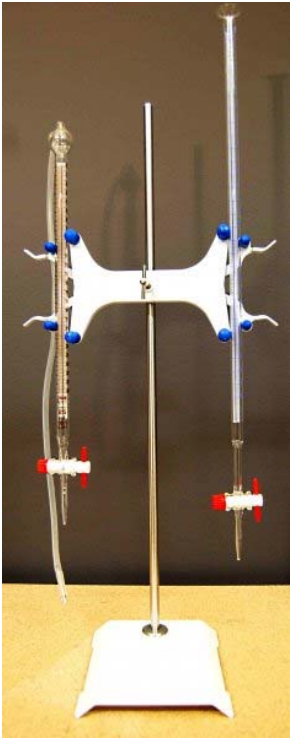
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# Acidity – Titratable Acidity (T.A.)

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- Obtain 50 mL clear juice
  - Measure at room temperature
  - Pipet 10 mL juice into flask
  - Add phenolphthalein indicator
  - Titrate with 0.1 N NaOH solution to endpoint
  - T.A. (as g/L malic acid) = mL NaOH x 0.67
- $\text{g/L} = \text{ml NaOH} \times \text{normality NaOH} \times 0.067^{**} \times 1000 / \text{Sample Vol. (mL)}$
- \*\*Equivalent weight of malic acid

\*Vermont Hard Cider Co. (2015) Internal Procedure

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# Stability - pH

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- Calibrate pH meter with pH standards
- Obtain 50 mL clear juice
- Pour sample into beaker and stir
- Read measurement once stable
- Correct for temperature

\*Vermont Hard Cider Co. (2015) Internal Procedure

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Taste, Taste, Taste!

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**DON'T FORGET...**

**TASTE YOUR APPLES**

**TASTE YOUR JUICE**

**TASTE YOUR CIDER**

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Thank you!

Ben E Calvi

Cider Maker

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