# Craft Cidermaking

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# Beyond the Basics

Andrew Lea

With acknowledgement to

Charles W Radcliffe Cooke MP

Cider Enthusiast and Promoter

who wrote “A Book about Cider and Perry”

here at Hellens in 1898

*President of NACM*

*Founder Benefactor of Long Ashton Research Station 1903*

*Author of ‘Cider’ article in Encyclopaedia Britannica 1911*

# What do you do?

Who here already makes their own cider?

Hobby?

Commercial?

More than 70 hL?

Just starting out?

# The Basics!

## Step by Step Guide

- Select and collect your apples
- Mill the apples to a pulp
- Press out the Juice
- Let the juice ferment
- Rack and store the cider
- Drink and Enjoy!!

# Let’s dig a bit deeper!

- Fruit selection and blending
- Yeast and sulphiting
- Malo-lactic maturation
- Carbonation
- Sweetening
- “Keeving”
- Style of finished product
- Faults

# Choice of cider fruit

# The traditional classification (Barker, LARS, 1905)

| | **Acid %** | **Tannin %** |
|---|---|---|
| Sweet | < 0.45 | < 0.2 |
| Sharp | > 0.45 | < 0.2 |
| Bittersharp | > 0.45 | > 0.2 |
| Bittersweet | < 0.45 | > 0.2 |
| **Finished Cider** | **~ 0.45** | **~ 0.2** |

……Blending is the cidermaker's art!

# Choice of “vintage quality” fruit

Term devised by Hogg 1886

Adopted by Barker 1910 to embrace superior qualities that could not be determined by analysis

# UK "Vintage Quality" List (1988)

**Sharps / Bittersharps**

- Dymock Red
- Kingston Black
- Stoke Red
- Foxwhelp
- Browns Apple
- Frederick
- Backwell Red

**Bittersweets**

- Ashton Brown Jersey
- Harry Masters Jersey
- Dabinett
- Major
- White Jersey
- Yarlington Mill
- Medaille d'Or

**Pure Sweets**

- Northwood
- Sweet Alford
- Sweet Coppin

# Choice of Orchard Type

- A **traditional** orchard
  - 30 standard trees per acre
  - Sheep or cattle graze underneath
  - Higher landscape value
- An **intensive** orchard
  - 300 bush trees per acre
  - Grass cover with herbicide strip
  - No livestock

# Influence on Cider Quality?

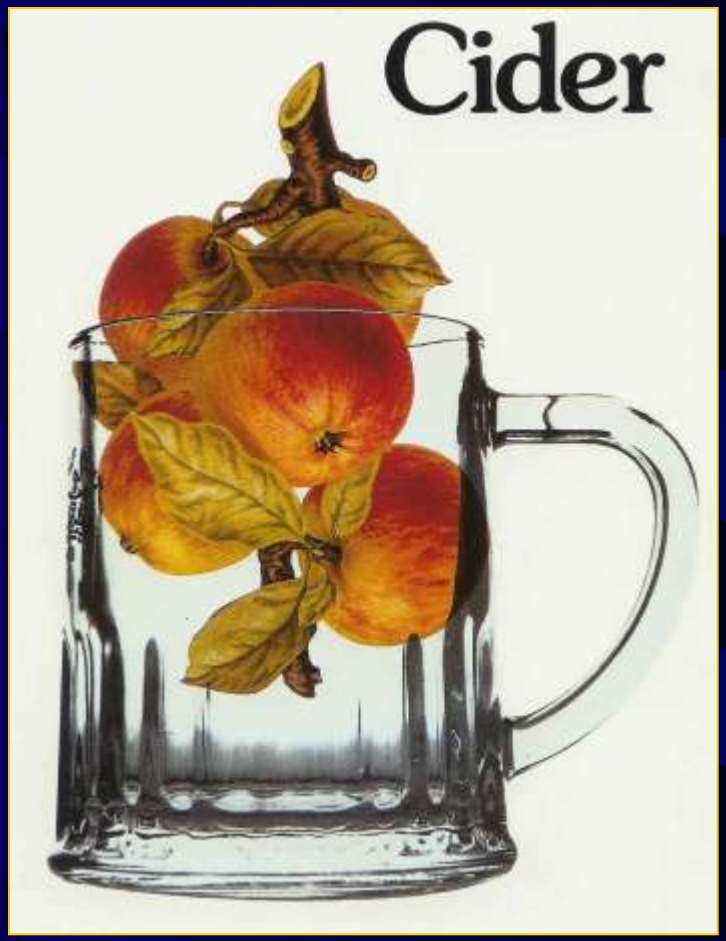
- Standard trees (especially in old orchards) tend to lower nitrogen levels
- They tend to ferment more slowly
- This may be beneficial to ultimate cider quality

# Fruit Storage?

- Not all apples are ripe when picked
- Mid /late season apples mature when stored
  - Starch converts to sugar
  - Volatile flavour develops
- Practical considerations are important too
  - e.g. protection from pests

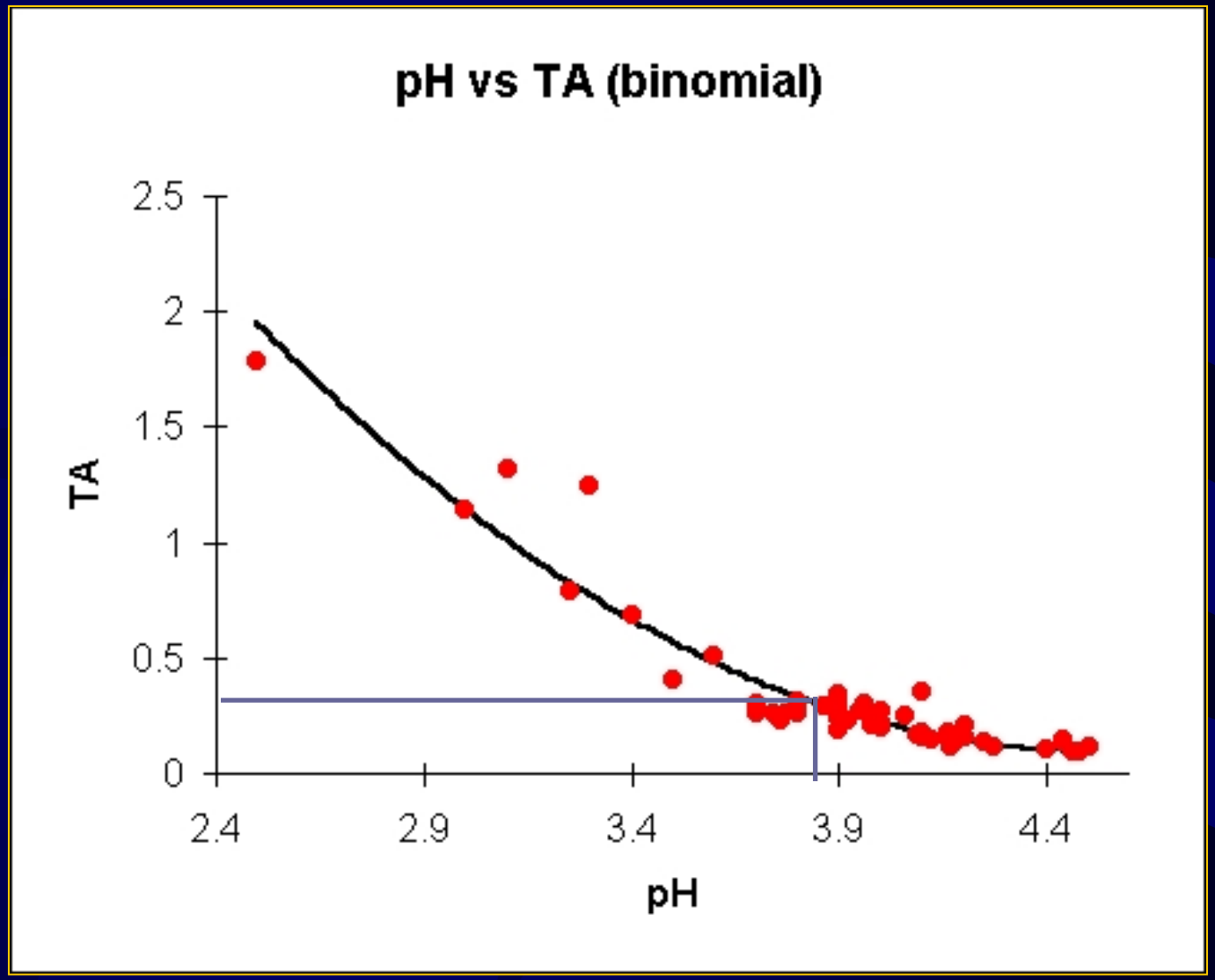
# Blending or Single Varietals?

- Blending before fermentation can ensure good pH control (< 3.8)
- High pH (bittersweet) juices prone to infection
- Single varietals may be unbalanced
  - unless ameliorated with dilution or added acid



# pH vs Titratable Acid

- Inverse relationship is not exact
- Measure using narrow range test strips or a pH meter
- < pH 3.8 is a good place to be before fermentation (> 0.4% TA)



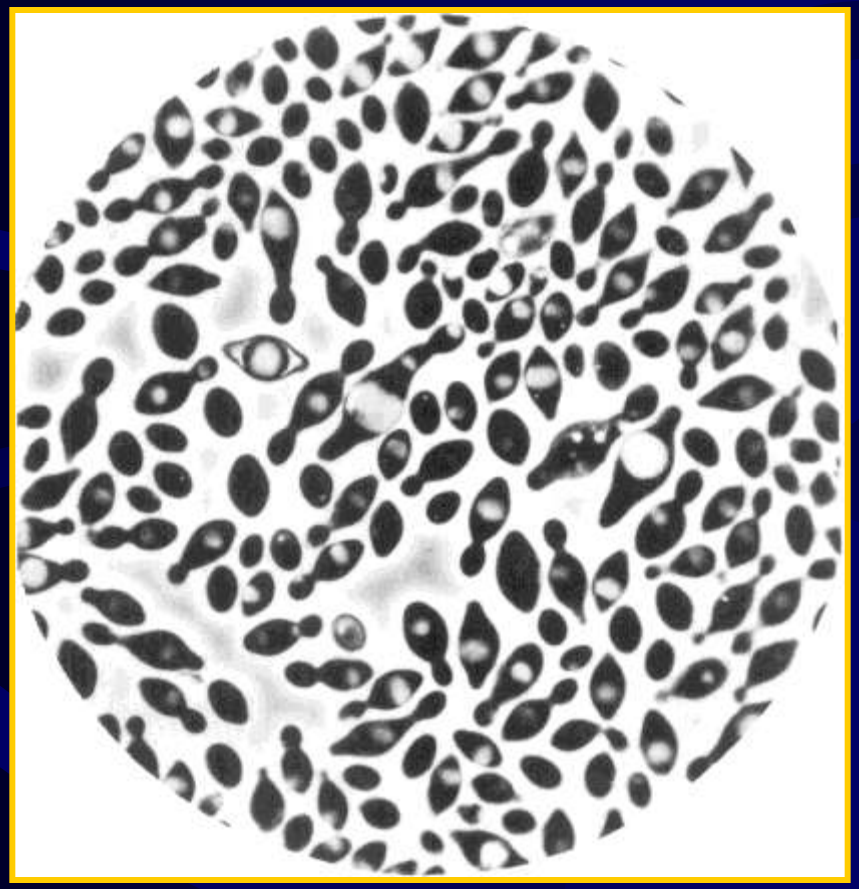
# Fermentation (old and new)


Yeasts wild or cultured?

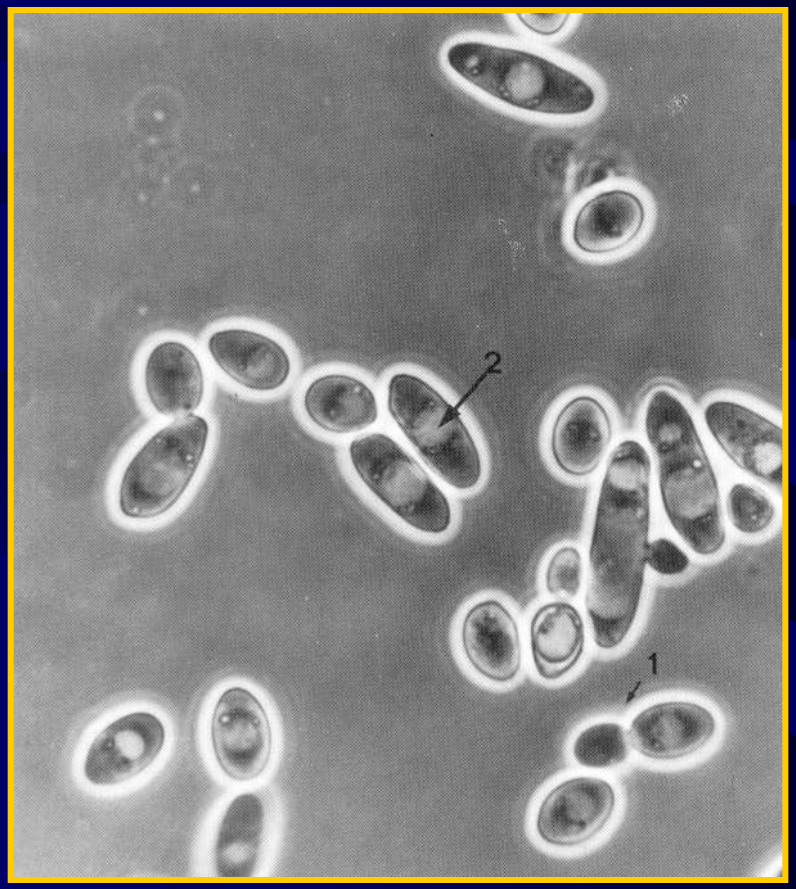
# Wild Yeast

- Wild yeasts are everywhere
- The inoculum stays on fruit, cloths and equipment
- A succession of yeasts grow and ferment during traditional cider fermentation
- *Kloeckera apiculata* starts ; dies at 4% alcohol
- *Saccharomyces cerevisiae* slowly build up to finish
- This may take 3 – 4 months

# The main protagonists



K. apiculata




S. cerevisiae

# Pure Culture Yeasts

- Defined strains of monoculture wine yeasts
  - *Saccharomyces cerevisae* and *S. bayanus*
    - e.g.71B, V1116, EC1118, AWRI 350


- Pitch large inoculum into sulphited juice
  - fast fermentation in as little as 2 weeks

# Yeast Comparison

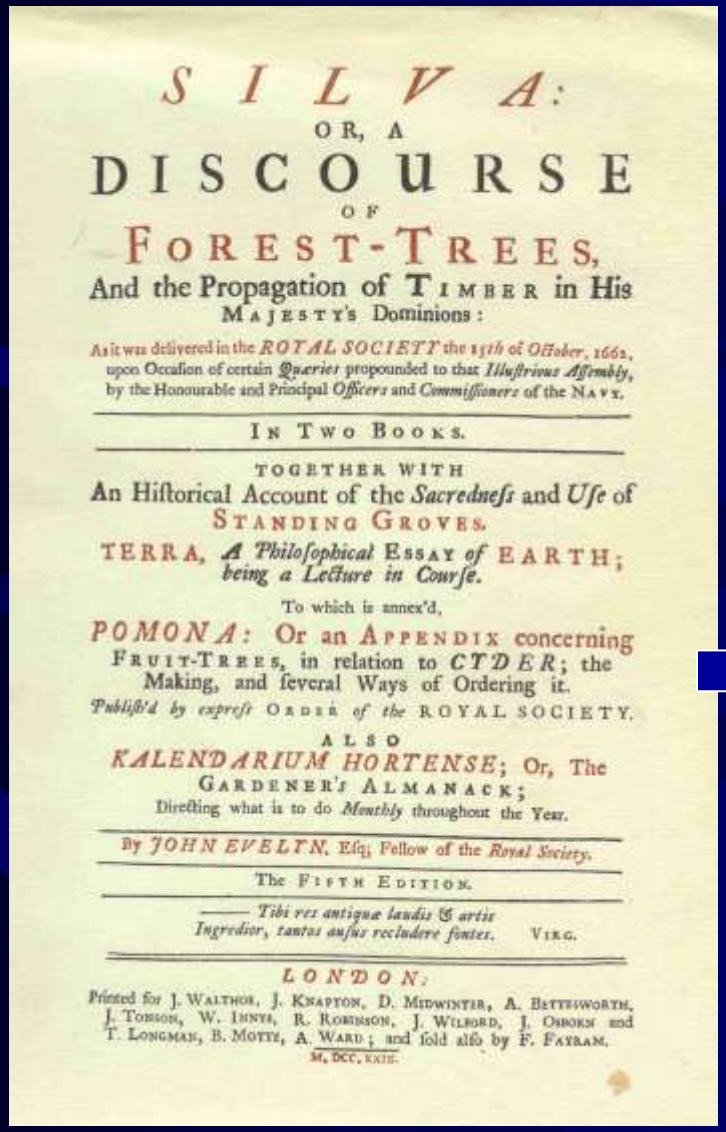
**Wild**

- Slow but may tolerate ~4° C
- Succession gives more complex flavour development
- Some risk of acetic / sulphidic flavours persisting
- Flocculation may be poor
- Benefit from good pH control and use of $SO_2$

**Cultured**

- Fast but need > 10° C
- Ferment dry and wine-like
- Flavours generally clean but may need nutrients to ensure this
- Flocculation typically good
- Benefit from good pH control and use of $SO_2$

# Fire and Brimstone!



SILVA:
OR, A
DISCOURSE
OF
FOREST-TREES,
And the Propagation of TIMBER in His
MAJESTY'S Dominions:

As it was delivered in the *ROYAL SOCIETY* the 15th of October, 1662, upon Occasion of certain *Quæries* propounded to that *Illustrious Assembly*, by the Honourable and Principal *Officers* and *Commissioners* of the NAVY.

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TOGETHER WITH
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STANDING GROVES.
TERRA, *A Philosophical* ESSAY *of* EARTH; *being a Lecture in Course.*

To which is annex'd,
*POMONA:* Or an APPENDIX concerning FRUIT-TREES, in relation to *CYDER*; the Making, and several Ways of Ordering it.
*Publish'd by express* ORDER *of the* ROYAL SOCIETY.

ALSO
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By *JOHN EVELYN*, Esq; Fellow of the *Royal Society*.

The FIFTH EDITION.

—— *Tibi res antiquæ laudis & artis*
*Ingredior, tantos ausus recludere fontes.* VIRG.

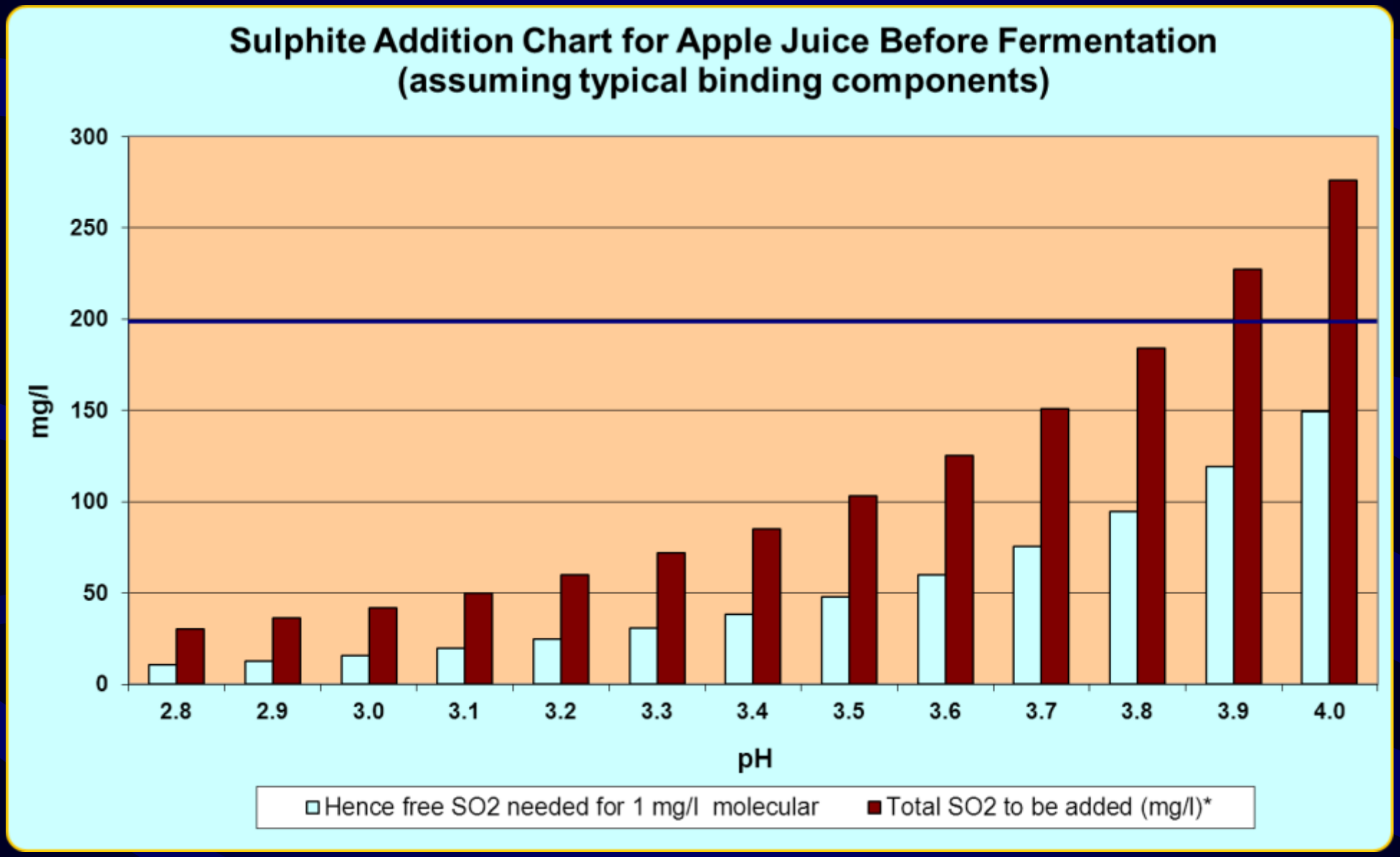
*LONDON:*
Printed for J. WALTHOE, J. KNAPTON, D. MIDWINTER, A. BETTESWORTH, J. TONSON, W. INNYS, R. ROBINSON, J. WILFORD, J. OSBORN and T. LONGMAN, B. MOTTE, A. WARD; and sold also by F. FAYRAM.
M, DCC, XXIII.

**"Lay Brimstone on a Rag, and by a Wire let it down into the Cider-Vessel, and there fire it; and when the Vessel is full of the Smoak, the Liquor speedily pour'd in, ferments the better"**

[Dr Beale FRS in Evelyn's *Pomona* **1664**]

# Sulphur Dioxide in the 21st Century

- Controls adverse bacterial and yeast infection
- Added most conveniently as 10% metabisulphite solution (5% $SO_2$) or as Campden tablets
- Binds to juice components especially from rotten fruit
- Its equilibrium is very pH dependent
- Active range is 0.5 - 1 ppm (mg/l) molecular $SO_2$
- To achieve 1 ppm active molecular $SO_2$, up to 200 ppm total might need to be added at pH 3.8
- Lag phase while wild *S. cerevisiae* multiplies may be 2 weeks or longer; cultured yeasts are much quicker




…..or at least try "1 Campden tablet per gallon"!!

# Cider Maturation

- Traditional ciders finish fermenting in the spring
- As the weather warms up and the trees bloom, the cider starts to ‘work’ again and becomes less harsh in flavour
- Evidently the cider and the trees are somehow in sympathy!

# This is the Malo-Lactic Change

- Malic is the principal acid in apple. It is decarboxylated by lactic acid bacteria to give $CO_2$ and lactic acid

$$\mathbf{HOOC.CHOH.CH_2.COOH} \rightarrow \mathbf{HOOC.CHOH.CH_3} + \mathbf{CO_2}$$

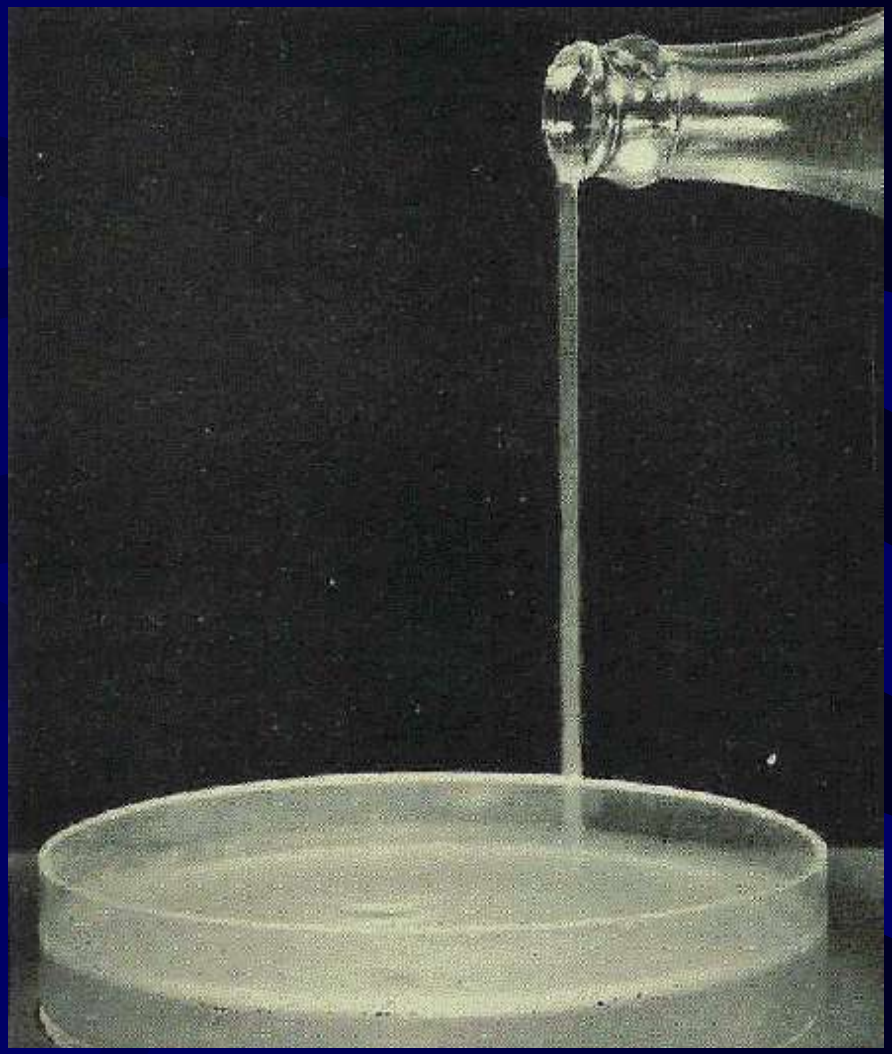
- Hence the acidity falls by 50% and the cider becomes slightly carbonated
- Other interesting flavour changes occur too particularly the spicy / old horse note

# Wooden Vats

- Old oak vats largely provide an inoculum for malo-lactic organisms...
- …unlike wine where oak flavours are transferred from new barrels
- Wood can be a USP
  - but also a false friend!

Not all malo-lactic bacteria are good

- Ropiness
- Mousiness
- Excess acid loss
- Danger of working at pH > 3.8 without $SO_2$



# Controlling Malo-Lactic Change

**Promote**

- Old wooden casks
- Higher pH
- Stand on lees
- No $SO_2$ on storage
- Add a bacterial culture

**Inhibit**

- Use sterilised tanks
- Keep pH down
- Rack off lees
- Add $SO_2$ for storage
- Use lysozyme

# Use of Malo-Lactic Cultures

- Cultures have been selected for the wine industry from well-behaved *Oenococcus oeni*
- An exciting and under-explored area for cider-makers especially those using dessert or cull fruit whose ciders are too sharp
- Now relatively pH and sulphite tolerant
- Can lower acidity from 1% - 0.5% at > 15°C
- But no spicy notes from this organism!

# Storing Bulk Cider

*"L'air est l'ennemi mortel du cidre"*

French cidermaking leaflet

- Keep tight!
- Keep full!
- $CO_2/N_2$ blanket if part-filled
- Use $SO_2$ (50 ppm)

# Finished Cider - Dry or Sweet ?

- Dry cider does not appeal to all
  - sugar / acid / tannin balance
  - SG 1.005 - 1.020 is preferred range (as sugar)
- Added sugar risks refermentation unless pasteurised. Permitted alternatives are
  - Saccharin
  - Acesulfame-K (aspartame isn't stable long-term)
  - Sucralose (becoming widely used by small makers)
- Alternatives lack 'body' compared to sugar

# Finished Cider - Fizzy or Flat ?

- Carbonation lifts the flavour of a cider
  - and provides greater perceived acidity
  - Typically 5 - 12 g/l (1 - 4 atmospheres at 10°C)
  - Usually achieved by ‘force carbonation’
- Saturation solubility of $CO_2$ is 2.5 g/l at 10°C
  - a sub-saturation carbonation of 1 g/l is normal for still white wines
  - enhances flavour balance and body
  - provides some anti-microbial effect

# Natural Ways

## Carbonation

Bottle conditioning

- @SG 1.005 ‘crown cap’
- @SG 1.010 ‘mushroom’

The residual or added yeast produces $CO_2$ in bottle

## Retained Sugar

Repeated racking of slow fermentation

- requires wild yeast
- requires low $N_2$ fruit

Can stabilise at SG 1.010

Can combine the two through ‘keeving’

# A diversion through Keeving…

- ‘Keeving’ is the old English and French method
- Still common practice in Devon pre-1939
- Allows production of naturally sweet cider
- The juice stands for several days in the cold
- The ‘flying lees’ or *chapeau brun* rises spontaneously to the top
- The clear juice below is pumped off to ferment very slowly for the next three months

# Science explains tradition!

- Apple pectin is a highly methoxylated polygalacturonic acid which is slowly de-esterified by an endogenous esterase
- The liberated polygalacturonate (pectate) anion combines with free cations in the juice, notably calcium, asparagine and thiamin
- This calcium pectate gel rises to the top buoyed up by $CO_2$ from the yeast

# The result...

- Clear juice depleted in amino nitrogen and thiamin
  - they bind to the pectate
- Hence yeast nutrient and vitamin level is very low
- So the fermentation is very slow and traditionally can take 3 - 4 months in the winter
- Repeated racking stops fermentation
- Cider may be filtered and bottled at SG 1.010 – 1.025
- Slight carbonation develops in the bottle
- Disappeared commercially post-1945 in UK

# Keeving is obsolete(?) in England

- But is the norm in France as ‘défécation’, where they now use:
  - Added commercial PME (*Rapidase CME*)
  - Added calcium (as the chloride)
  - Nitrogen bubble flotation in larger factories
  - Fermentation at *ca* 4° C
  - Frequent centrifugation to remove the yeast crop

- This produces a naturally sweet cider of full flavour and low alcohol (a craft cidermaker’s USP?)
- There is a considerable revival of interest in the UK

# Finished Cider - Bottle or Cask?

- Cider was first bottled in the 1640's in the Forest of Dean
- The slight continued fermentation gave 'natural condition' and sparkle
- Pre-dates Champagne by at least 50 years!
- The gentry had specially-made glasses to drink from

# Bottled ciders

## Traditional (conditioned)

- Took cider to new markets in 19th century
- Can keep (and mature?) for years in glass
- Yeast in finished product
  - Risk of exploding bottles at SG> 1.005
- Virtually died out after WW2

## Modern

- Sweetened, carbonated and pasteurised for stability
- Can be contract packed (in glass)
- Some bottle conditioned ciders are creeping back
  - True *"methode champenoise"* is also possible (no yeast in finished product)

# Finished Cider - Bottle or Cask?

- Cider in traditional cask is difficult to keep well past early summer
- It needs protection from airborne contamination e.g. *Acetobacter* and *Brettanomyces*
- Cider mugs were popular for cask ciders in 18th and 19th century taverns

# Cask ciders

## Traditional

- Has to be drunk quickly once broached
- Prone to acetification and mousy off-flavours on exposure to air
- Can be ‘re-conditioned’ by adding sugar and yeast
- Haze may be +ve USP

## Modern

- Filtered, carbonated, pasteurised and sweetened into kegs
- Beer dispense systems
- Good storage life
- Collapsible bag-in-box
  - If carbonation is not required
  - Can pasteurise B-i-B

# When things go wrong

| Problem | Remedy |
| --- | --- |
| • Stuck fermentation | • Use thiamin / nutrients |
| • Film yeast | • Eliminate headspace , use $SO_2$ |
| • Ropiness (bacterial) | • Agitate and use $SO_2$ |
| • Sulphury aromas | • Use copper? In future add nutrients |
| • Blackening / greening | • Avoid contact with non SS metal |
| • Acetification | • Eliminate air, use $SO_2$, re-ferment |
| • Mousiness | • No treatment. Sterilise and start again |

# Cider Quality depends upon…..

- Juice Composition
  - apple juice (source, blending etc.)
- Fermentation Control
  - yeast management (sulphite, nutrients etc.)
- Post fermentation handling
  - directing maturation
  - preventing oxidation

**THE CHOICES ARE YOURS!**

# More information

Book “Craft Cider Making”

Website www.cider.org.uk
Slides of this talk at
www.cider.org.uk/hellens.pdf

Discussion Groups
Cider Workshop
www.ciderworkshop.com

Cider Digest
www.talisman.com/cider/index.html#Digest