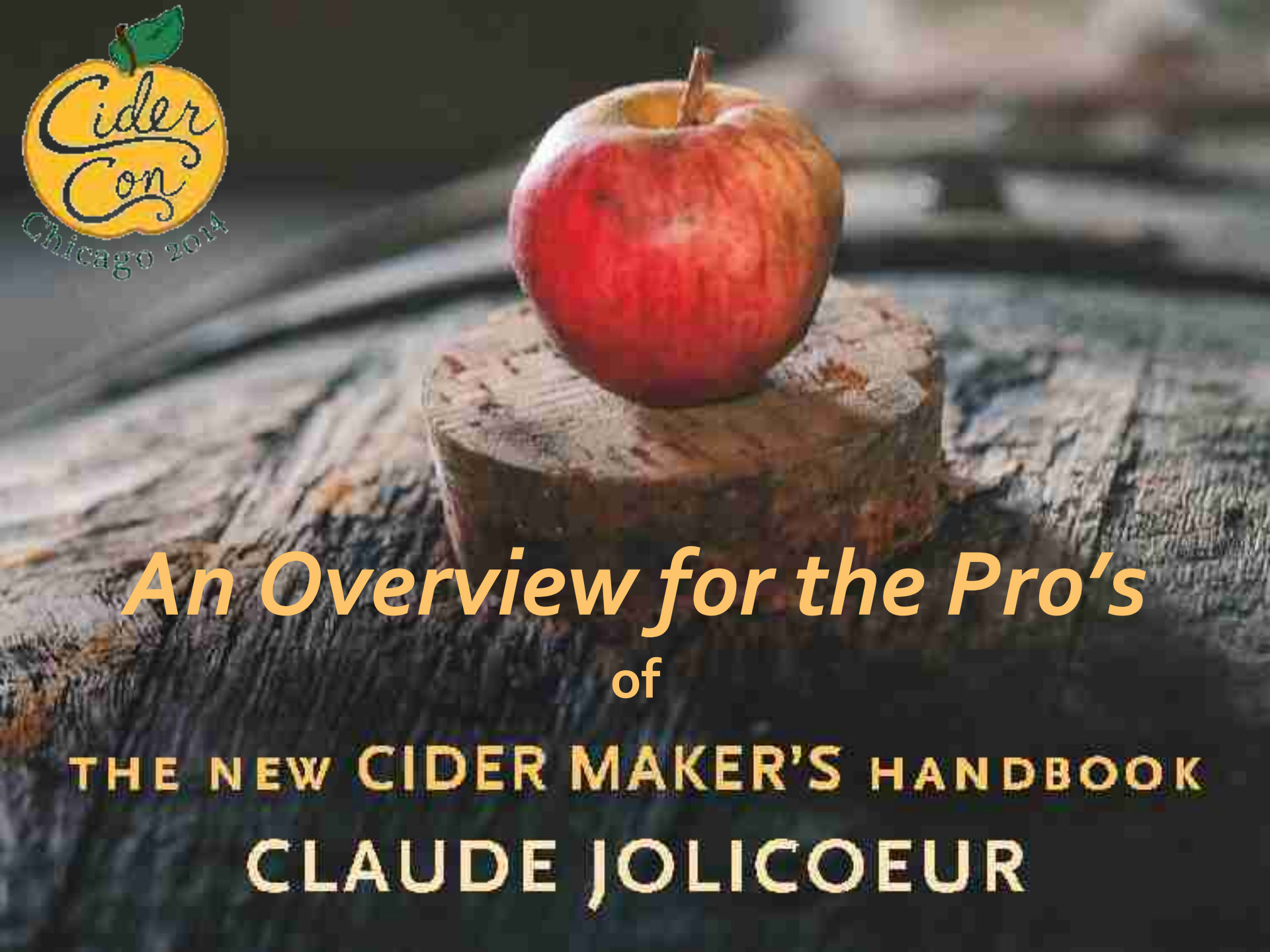

Cider Con
Chicago 2014
An Overview for the Pro's
of
THE NEW CIDER MAKER'S HANDBOOK
CLAUDE JOLICOEUR

CONTENTS of the BOOK

INTRODUCTION

- This book puts a lot of emphasis on producing the finest possible ciders.
- Why this search for quality in ciders?
  - The image problem of cider (compared to wine).
- How to improve the quality of cider?
  - Understanding what is going on
  - Work on the fruit - cultural practices
  - Work on the blend, with a better variety mix
  - Improve the fermentation processes
- No recipes, but hopefully, inspiration...

PART I
The Basics of Cider Making

The first part is written for the novice cider maker. It presents basic cider making practices which are important to master before starting to do new or more complex things. We'll skip this...

CHAPTERS:

1. Material and Supplies
2. The Raw Material: Apple Juice
3. Cider Preparation

PART II
Growing Apples for Cider

Part II is on obtaining the best possible apples for preparing the cider through adequate cultural practices and varietal selection. As you will see, I believe the quality of the apples to be a most important factor in obtaining a superior cider.

CHAPTERS:

4. The Cider Orchard
5. The Varietal Selection

Any apple good enough for cider?

Whoever thinks that "any apple is good enough for cider" had better not engage in the business. *He probably would not know a good article of cider if by any accident he should ever taste one. This book is designed to guide those who intend and desire to make the best, and are to be satisfied with nothing less.*

J.M. Trowbridge

The Cider Maker's Handbook, 1917

What is a great apple for cider?

- High in sugar and in flavor.
- Low in nitrogen.
- Perfectly ripe or even slightly overripe.
- Appropriate variety for the blend with right quantity of acid and tannin.

On the other hand, the appearance isn't important as the cider drinker doesn't see the fruit… **Different cultural practices**.

Chapter 4 CIDER ORCHARD

- Cultural practices, how they are different from those for table apples, and their influence on quality.

- Orchard models.
  - Extensive orchard
  - Bush orchard

- Orchard planning.

Extensive orchard: old standard trees

Cider-bush orchard: Steve Wood's Poverty Lane in NH

Chapter 5 VARIETAL SELECTION

- Cider-apple classification systems.
  - England / France / Spain / North America
- Recommended varieties by region.
  - Quebec / New England / Rocky Mountains / Maritimes / PNW / Mid-Atlantic / Great Lakes
- Directory of apple varieties for North America.
  - Over 60 varieties of cider-appropriate apples and pears described.

Cider-apple classification

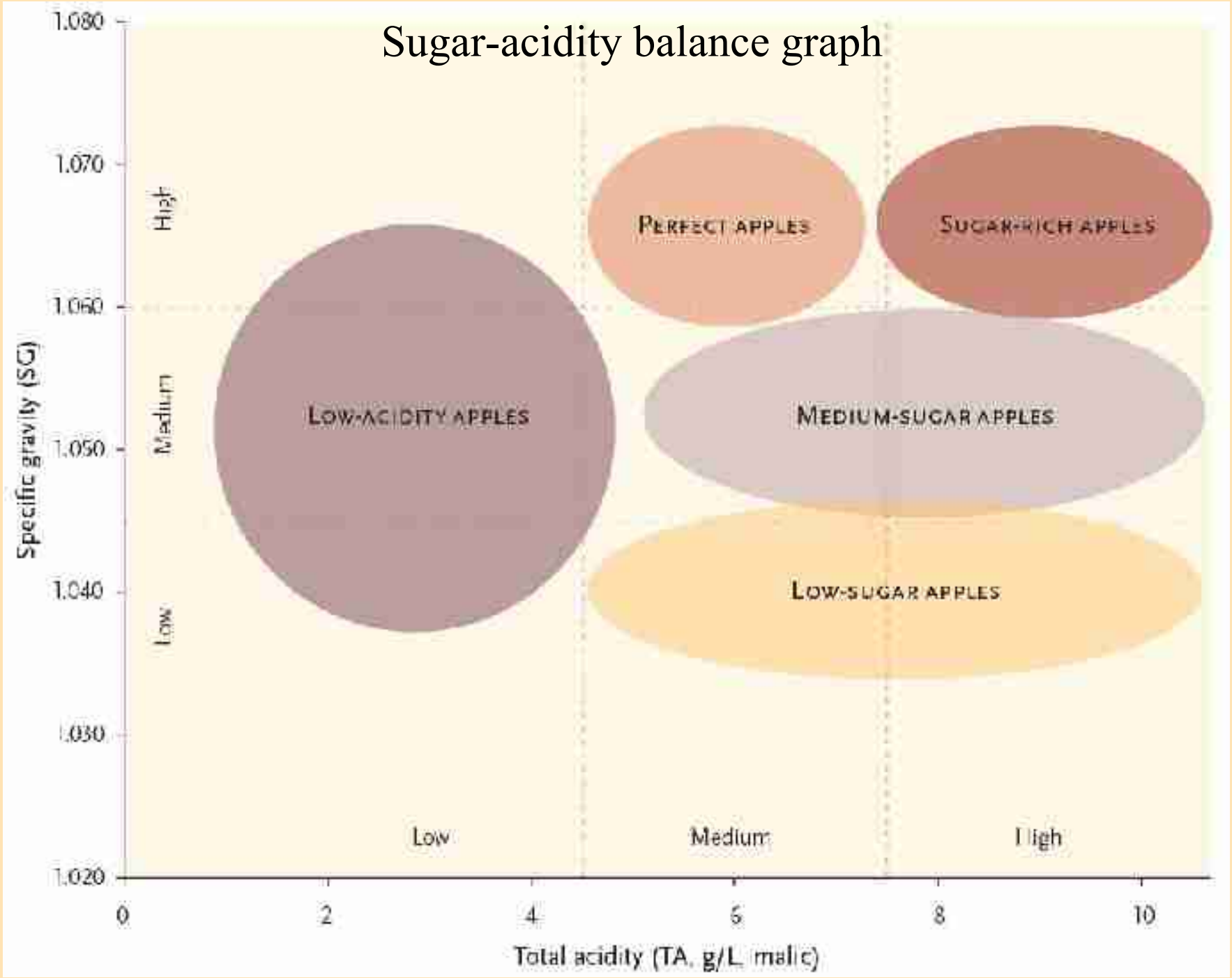
Cider-apple varieties are classified according to their content in:

- sugar
- acids
- tannins

TABLE 5.4:
Classification according to the concentration of properties

Concentration	Sugar Specific Gravity (SG)	Acidity (g/L as malic acid)	Tannins (g/L as tannic acid)
Low	less than 1.045	less than 4.5	less than 1.5
Medium	1.045 to 1.060	4.5 to 7.5	1.5 to 2.5
High	1.060 to 1.070	7.5 to 11	over 2.5
Very high	over 1.070	over 11	

Sugar-acidity balance graph



Directory of varieties

Belle de Boskoop

Number of samples tested: 3
Sugar: very high, SG 1.070 (1.066–1.074)
Acidity: very high, TA 12.8 g/L (11.6–13.4)
Tannin: low
Juice yield: high
Harvest date: late September;
pressing season: late
Cultural notes: very vigorous, triploid,
good hardiness, no scab issue

Belle de Boskoop (figure 5.3) is a Dutch apple, discovered in 1856 and generally considered to be a mutation of Reinette Montfort. The original name is Schoener von Boskoop, and it is often called simply Boskoop. It is popular in France, in particular in the northern part of the country. This is an all-purpose apple, good for dessert, cooking, and cider. The fruit is large and beautiful, heavily russeted and with an excellent flavor with a hint of lemon taste. It is one of my favorites, and I consider it a first-choice apple for cider with its very high sugar concentration, though one has to be careful with its acidity, which will need to be blended down with some low-acidity varieties.

Bilodeau

Number of samples tested: 9
Sugar: high, SG 1.065 (1.050–1.076)
Acidity: high, TA 7.5 g/l (6.2–8.9)
Tannin: medium, juice slightly astringent
Juice yield: medium to high
Harvest date: early to mid-September;
first pressing season

PART III
Juice Extraction

Part III covers the extraction of the juice from the apples. This is mostly aimed for hobbyists or very small commercial operation.
Since you are all pro's we will skip this...

CHAPTERS:

6. Apple Mills
7. Apple Presses

PART IV
The Apple Juice or Must

Part IV is on the apple juice and how its properties may be infuential in the cider that will be obtained from it.

CHAPTERS:

8. The Sugars
9. The Acids
10. The Tannins or Phenolic Substances
11. The Nitrogenous Substances
12. The Pectic Substances

The sugars

- Measurement and evaluation.
  - g/L of sugar, density (SG, volumic mass), Brix, potential alcohol
- Hydrometer to measure density.
- Relation between SG and true sugar content.

TABLE 8.1:
Classification of apples according to their richness in sugar

Sugar content	Specific gravity	Remarks
Low	1.045 and less	Summer apples and cooking apples; not recommended for cider unless they have other desirable qualities
Medium	1.045–1.060	Good
High	1.060–1.070	Ideal for cider
Very high	over 1.070	Exceptional; crabapples sometimes have such high sugar content

The original Dujardin-Salleron sugar table (early 1900's)

DUJARDIN-SALLERON, PARIS

Densités à 15° Poids en grammes d'un litre de moût	Grammes de sucre par litre de moût	Degré alcoolique probable du cidre fait Litres d'alcool par hectolitre	Densités à 15° Poids en grammes d'un litre de moût	Grammes de sucre par litre de moût	Degré alcoolique probable du cidre fait Litres d'alcool par hectolitre	Densités à 15° Poids en grammes d'un litre de moût	Grammes de sucre par litre de moût	Degré alcoolique probable du cidre fait Litres d'alcool par hectolitre
1001	0.25	0.01	1035	72.	4.33	1068	147.5	8.94
1002	2.	0.12	1036	74.	4.44	1069	149.5	9.05
1003	4.	0.24	1037	76.	4.60	1070	151.5	9.16
1004	7.	0.42	1038	78.	4.71	1071	153.5	9.27
1005	10.	0.60	1039	80	4.82	1072	155.5	9.38
1006	12.	0.73	1040	82.	4.94	1073	157.5	9.54
1007	14.5	0.87	1041	84.	5.10	1074	159.5	9.66
1008	16.	0.97	1042	86.5	5.24	1075	161.5	9.77
1009	18.	1.09	1043	89.5	5.43	1076	164.	9.93
1010	20.5	1.26	1044	92.	5.57	1077	166.	10.04
1011	22.	1.34	1045	94.5	5.71	1078	168.	10.15
1012	24.	1.46	1046	97.5	5.84	1079	170.	10.26
1013	26.	1.58	1047	100.	6.05	1080	172.	10.42
1014	28.5	1.70	1048	103.	6.16	1081	174.	10.53
1015	30.5	1.86	1049	104.5	6.30	1082	176.	10.64
1016	32.	1.95	1050	107	6.49	1083	178.5	10.80
1017	34	2.07	1051	109.5	6.60	1084	180.5	10.92
1018	36.	2.19	1052	113.	6.79	1085	182.5	11.03
1019	38.	2.34	1053	115.	6.93	1086	184.5	11.14
1020	41.	2.47	1054	117.5	7.09	1087	186.5	11.30
1021	43.5	2.63	1055	119.5	7.24	1088	188.5	11.41
1022	44.	2.68	1056	121.5	7.35	1089	191.	11.57
1023	46.	2.80	1057	124.	7.51	1090	193.	11.68
1024	48.	2.92	1058	126.	7.62	1091	195.	11.79
1025	51.5	3.12	1059	123.5	7.76	1092	196.	11.87
1026	53.5	3.23	1060	131.	7.91	1093	198.	11.98
1027	55.5	3.34	1061	133.	8.06	1094	199.5	12.08
1028	57.5	3.45	1062	135.5	8.17	1095	201.5	12.21
1029	59.5	3.61	1063	137.5	8.33	1096	203.5	12.24
1030	61.5	3.73	1064	139.5	8.45	1097	204.5	12.35
1031	64.	3.89	1065	141.5	8.56	1098	206.	12.46
1032	66.	4.	1066	143.5	8.67	1099	207.5	12.57
1033	68.	4.11	1067	145.5	8.78	1100	208.5	12.60
1034	70	4.22						

(1) D'après originales publiées par Lechartier pour la Bretagne et Tardieu pour la Normandie.

Sugar in g/L (S) vs Density (SG)

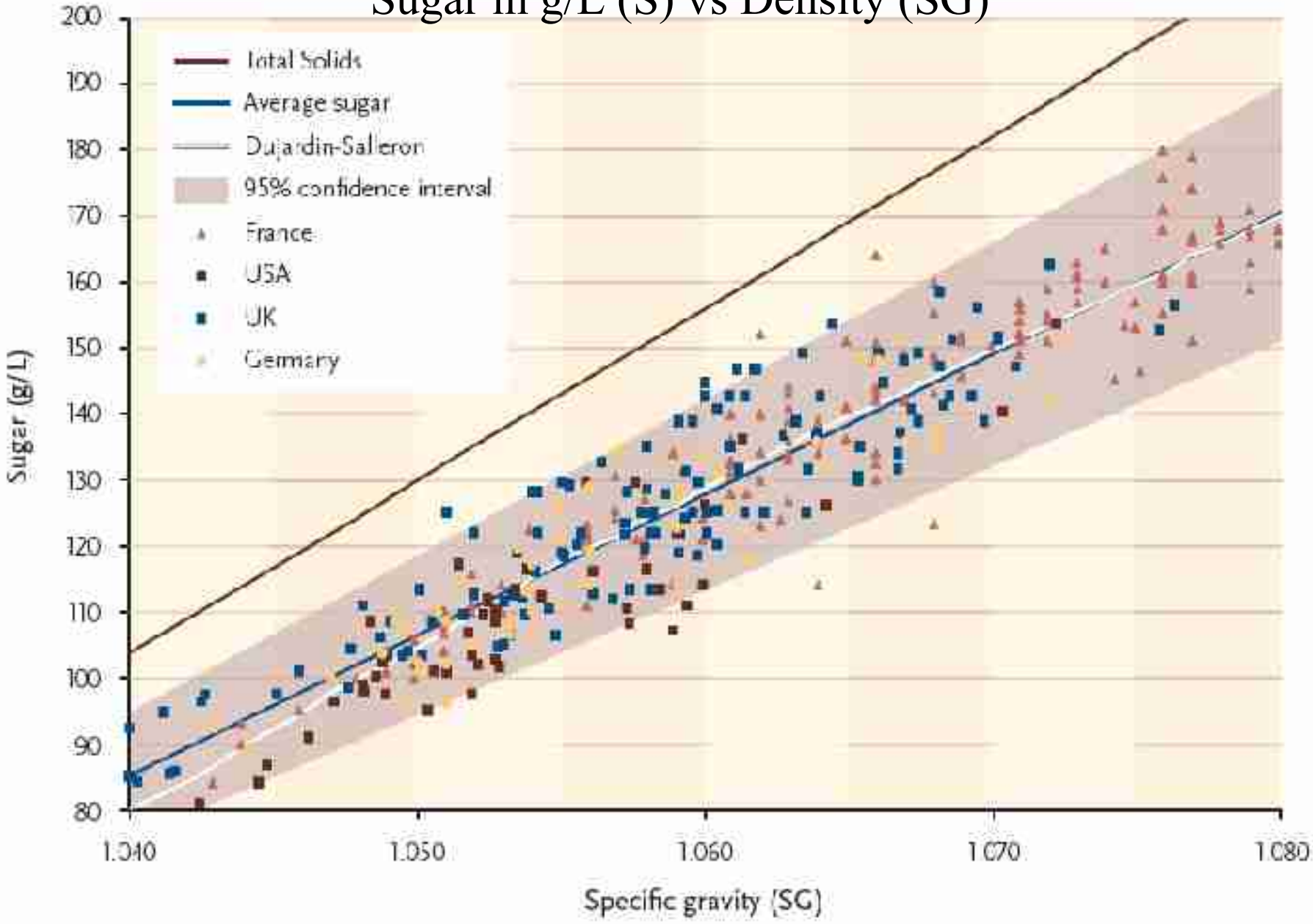


Figure 8.5. Graph of the sugar concentration as a function of the density for apple juice.

Need for new data

- The graph of the last slide could be made more exact…
- If some of you professional cider makers have laboratory analysis data with SG and sugar content in g/L for typical juice samples, adding this new data would probably permit reducing the scatter of the SG - S relationship.
- Please consider sending me such data, and it would be incorporated in a future edition of the book.

The acids

- Measurement and evaluation
  - TA: Titratable or Total acidity - taste, freshness.
  - pH: Potential hydrogen - biochemistry.
- Relation between TA and pH.

TABLE 9.1:
Apple classification according to their acidity

Acidity	TA (g/L as malic acid)	Type
Low	less than 4.5	Sweet apples
Medium	4.5 to 7.5	Balanced: ideal for cider
High	7.5 to 11	Many table apples
Very high	more than 11	Cooking apples, crabs

Acidity: pH vs TA

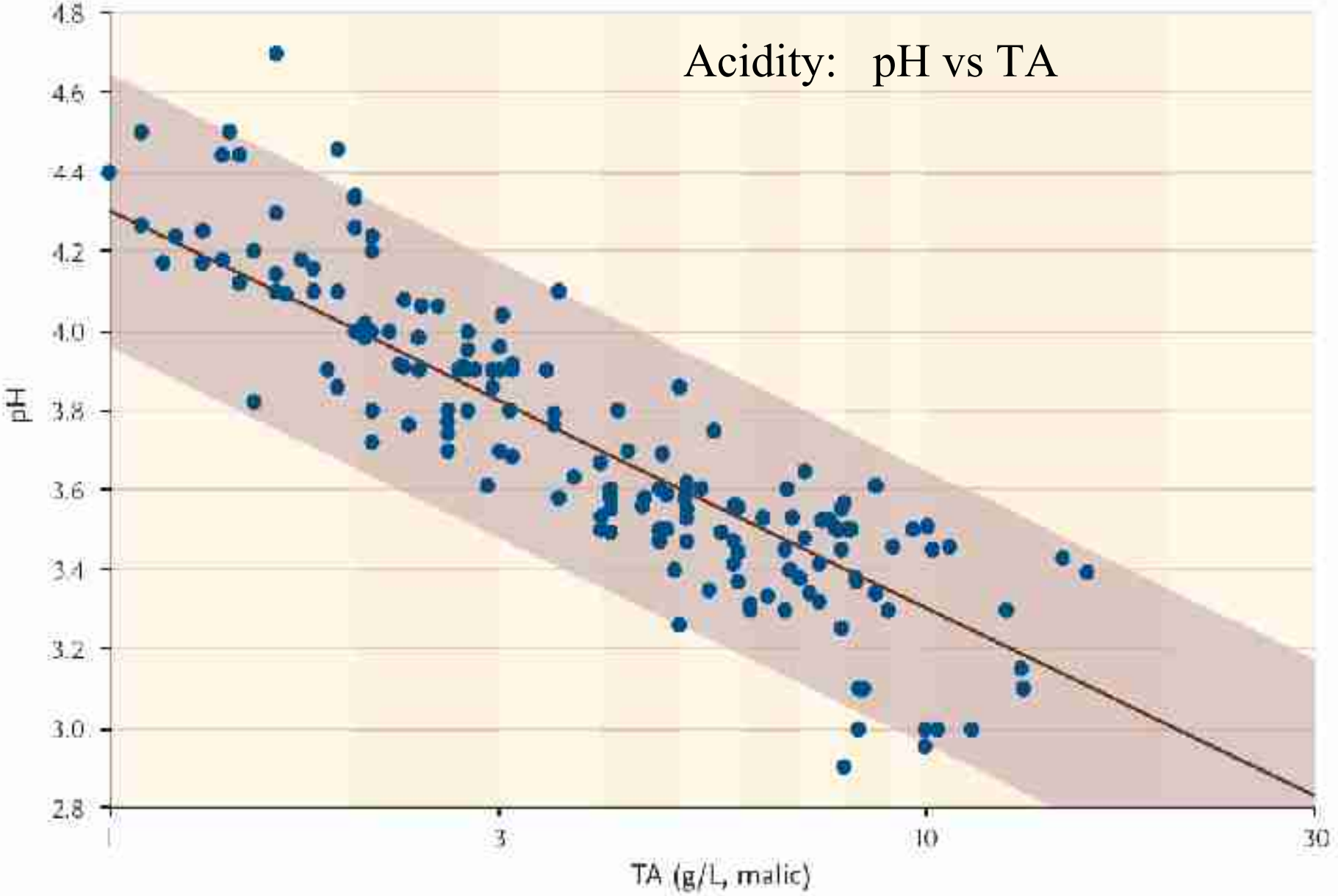


Figure 9.2. Graph of pH as a function of titratable acidity for 187 data points.

Chapter 10 TANNINS

- Phenolic substances:
  - Astringency: sensation of dryness in the mouth.
  - Bitterness: like what hops do to beer...
- Tannins give mouthfeel, structure to cider.
- Evaluated by our taste buds or lab analysis
  - low: less than 1.5 g/L tannic acid
  - medium: 1.5 to 2.5 g/L
  - high: over 2.5 g/L
- Important for the style of cider.
  - Most North American apples and ciders are low in tannins.

Chapter 11 NITROGEN

- Nitrogen is a natural yeast nutrient:
  - promotes rapid fermentation
  - complete fermentation to dryness
- Comes from the soil, which may be rich or poor, and from fertilization, either chemical or organic… and ends up in the juice.
- Some apple varieties are known to retain less nitrogen - the “Vintage” cider apples for example.

Chapter 12 PECTIN

- May cause hazes and clouds in cider.
- Discussion of enzyme action on pectin.
- Pectic enzyme treatments.
  - Simple pectinase addition
  - *Débourbage*, complete clarification before starting the fermentation
  - Keeving

PART V
Fermentation and Beyond

Part V is on cider making itself, the process of fermentation and transformation of the juice into cider.

CHAPTERS:

13. Blending
14. The Fermentation Process
15. Cider Diversity
16. Cider Troubles and how to Avoid Them

Chapter 13 BLENDING

A well-done cider is a subtle blend of different varieties, adapted to their terroir, each bringing a touch of acidity or bitterness, its richness in sugar and its perfume.

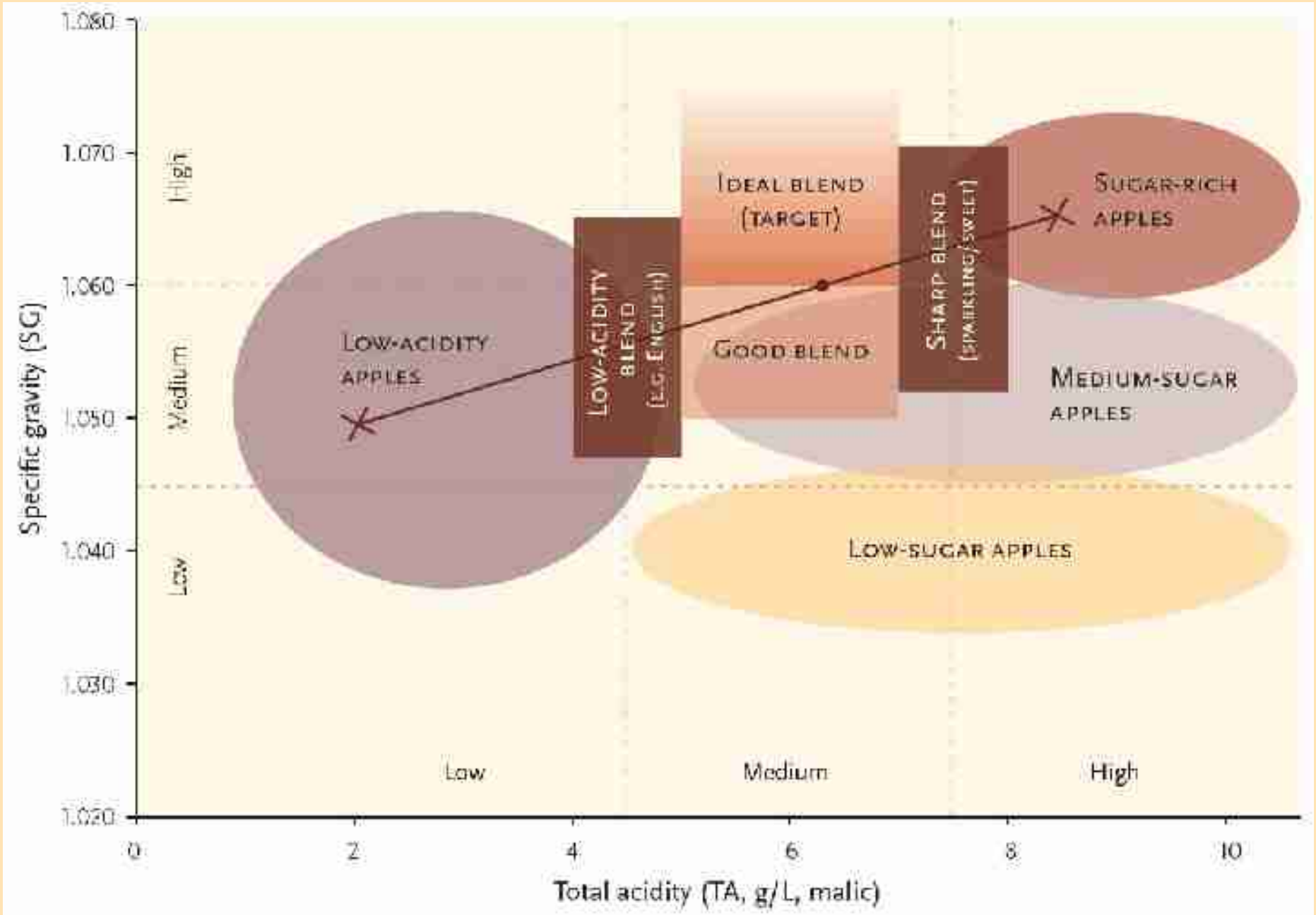
François Moinet

Le Cidre, Produire et vendre 2009

The ideal blend

- **Sugar** - as high as possible (usually).
  Min SG 1.045 (11 Brix).
  May be as high as SG 1.065 (16 Brix).
- **Acidity** - normal range of TA
  between 4.5 and 7.5 g/L as malic acid.
- **Tannins** - according to style of cider.

Blending for sugar and acidity



Blending Wizard

Variety	Quantity	Sugar	Acid	% of blend
Variety name 1	6	1.063	8.5	30%
Variety name 2	5	1.055	9.5	25%
Variety name 3	3	1.049	4	15%
Variety name 4	6	1.058	3	30%
				0%
				0%
				0%
				0%
				0%
				0%
				0%
Blend	**20**	**1.057**	**6.43**	

Chapter 14 FERMENTATION

- Sulfite (SO_2).
  - How it works / dosage / usefulness
- Yeast and yeast nutrients.
  - Yeast strategies / wild vs cultured / nutrients
- Monitoring and control of the fermentation.
  - FSU / racking / plots
- Malolactic fermentation.
- The alcohol.
  - How much is produced / measurement

Sulfite

- Sulfite useful to protect the cider from spoiling yeasts and bacteria.
- Dosage of sulfite according to pH of must.
- How sulfite works.
  - Bound / free / total / molecular
- Discussion on advantages and inconveniences of adding sulfite to the must.
- Testing of SO_2.

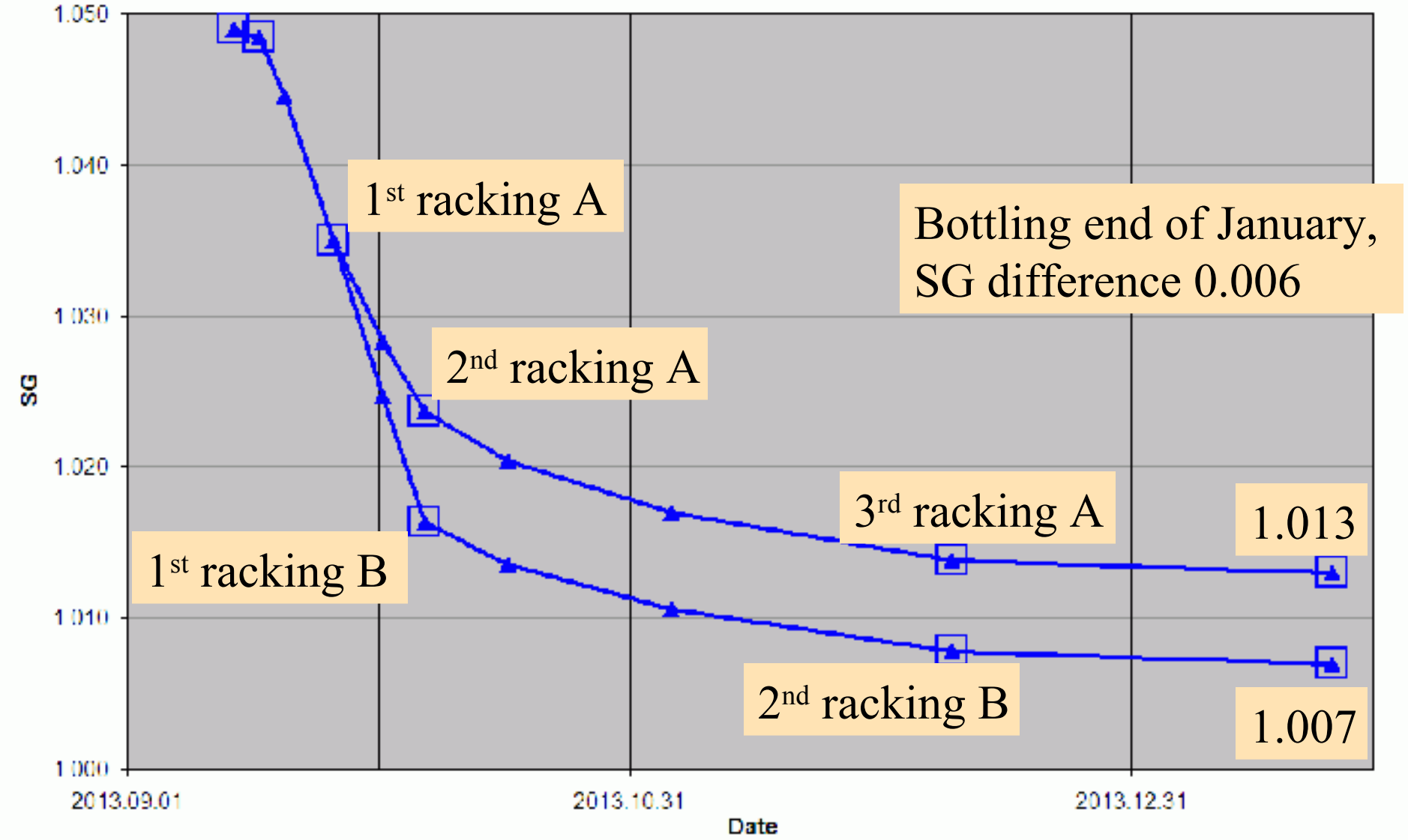
Yeast

- Strategies with yeast
  - Wild yeast fermentation
  - Wild yeast in partially sterilized must
  - Cultured yeast in an non-sterilized must
  - Cultured yeast fermentation in sulfite sterilized must
- Yeast nutrients - DAP
  - Effect of very small nutrient dosage.

Monitoring and control of the fermentation

- Fermentation speed
  - FSU : Fermentation Speed Unit
  - 1 FSU = speed that corresponds to a drop in SG of 0.001 in 100 days.
- Temperature control
  - Low temperature reduce speed (8-10ºC ideal)
- Racking as a way to reduce speed.
  - Not as efficient in large tanks / filtering.
- Plotting the evolution of fermentation.

Control by racking



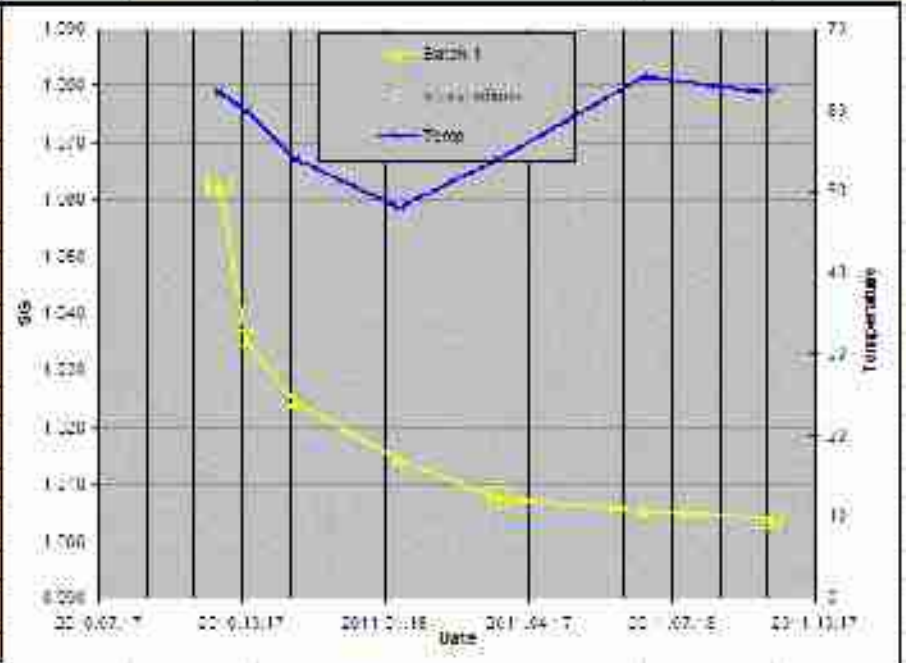
The Monitor spreadsheet

Fermentation monitoring and SG graph | **20XX** | **Batch 1**

Date	Temp	SG read	TA	Days	Temp (C)	SG corr	ABV	Observations
2010 10 01	62	1.0620	7	0	16.7	1.0622		pressing
2010 10 03	62	1.0620		2	16.7	1.0622	0	grains in mesh bag
2010 10 20	60	1.0350		19	15.6	1.0356	160	1st racking
2010 11 20	61	1.0200		50	16.2	1.0210	21	
2011 01 04	48	1.0160		95	8.9	1.0165	15	
2011 01 30	54	1.0080	6.5	121	12.2	1.0076	10	2nd racking
2011 02 20	61	1.0060		142	16.0	1.0051	6	
2011 03 06	62	1.0040	4.5	156	16.7	1.0042	4	Final SG gave 5.6% ABV

Temperatures in degrees F or C: F

Use the peach fields to enter your data
Do not modify yellow fields



The Alcohol

- Development of a model to predict alcohol strength and final SG of cider.
  - Pasteur relation
  - Volumic contraction of a water-alcohol mixture

- Discussion of various methods to measure alcohol strength of cider.

  Gravity drop / Residue / Ebulliometer / Distillation

Fermentation model for cider

20XX | Batch 1

Enter data in peach colored fields. | Do not overwrite the yellow fields

1- Properties and quantity of fresh juice.

(data from "Denc" tab, overwrite if required)

Fresh juice SG:	1.0574		Degrees Brix:	14.13	g/100g
Total acidity (grams of malic acid per liter):	6.43	g/l	Volumic mass of the juice (HU) at 20C:	1055.5	g/l
Quantity or volume of juice (at 20C):	20	liters	Total mass of juice:	21.11	kg

2- Adjustement to the sugar content:

This really is a fudge factor that permits to modify the sugar concentration of the juice. It is required because we can't know the exact amount of sugar from the SG. As discussed in the article on sugar concentration, we can only know the average sugar content from a large number of samples for a given SG. The adjustment factor is a correction in % which is added to or substracted from the average sugar (Savg) at the given SG.

Average sugar concentration for the given SG (Savg):			122.3	g/l
Total solids for the given SG (the true value of S cannot exceed this value) TS:			149.2	g/l
Enter here your adjustment factor. Note that it should normally be less than +/-11% as this number corresponds to the 95% confidence interval.				
Adjustment factor for sugar (+/-):	0	%	Adjusted sugar content (S):	122.3	g/l
			Potential alcohol:	7.5%	

3- Additions to the must and conditions prior to main fermentation

This section is to compute the effect of sugar and water additions to the must (the water may be added to dissolve the sugar prior to mixing, or to dilute the must). Note: to dissolve the sugar, a quantity of water of 2/3 to 3/4 of the quantity of sugar is usually adequate.

Quantity of sugar added (grams per liter of juice):	30	g/l		Total amount to add:	0.600	kg of sugar
Quantity of water added (ml per liter of juice):	22	ml/l		Total amount to add:	0.440	L of water
		Must SG after addition:	1.0662	SG variation:	0.0088	
		Brix (g/100g):	15.18	Potential alcohol:	8.9%	

4- Condition of the must after the main fermentation

Enter a value for residual sugar if you wish the program to compute the final conditions assuming that some of the sugar is not fermented.

Residual sugar (grams per liter):	0	g/l	SG:	0.9978	
			Alcoholic strength:	8.90	% ABV

5- Priming sugar and natural carbonation

Enter the quantity of priming sugar for natural carbonation and of water to dilute this sugar.

Volume of cider considered:	19	Liters				
Quantity of sugar added (grams per liter of juice):	12	g/l		Total amount to add:	0.228	kg of sugar
Quantity of water added (ml per liter of juice):	8	ml/l		Total amount to add:	0.152	L of water
		Cider SG after addition:	1.0024	SG variation:	0.0046	

6- Finished cider (assuming no MLF)

Residual sugar (grams per liter):	0	g/l				
Class of carbonation:	Sparkling	CO2 in solution (g/l):	6.74	Final SG:	0.9970	
Sweetness:	Dry	Volumes of CO2:	3.41	Alcoholic strength:	9.49	% ABV
		SG drop:	0.0054			

7- Analysis of cider

Analysis of the cider should give the following results. Boiling the alcohol and replacing with water would give:

Dry extract (DE):	25.5	g/l	SG after alcohol boil-off:	1.0098	From Hanneyman regression:	
Sugar free dry extract (SFDE):	25.5	g/l	SG variation (SG2-SG1):	0.0128	**Alcoholic strength:**	9.51	% ABV

8- Malolactic fermentation

In this section you may evaluate the variation of SG that would be caused by malo-lactic fermentation.

Enter the percentage of the malic acid present in the cider that is transformed in lactic acid.

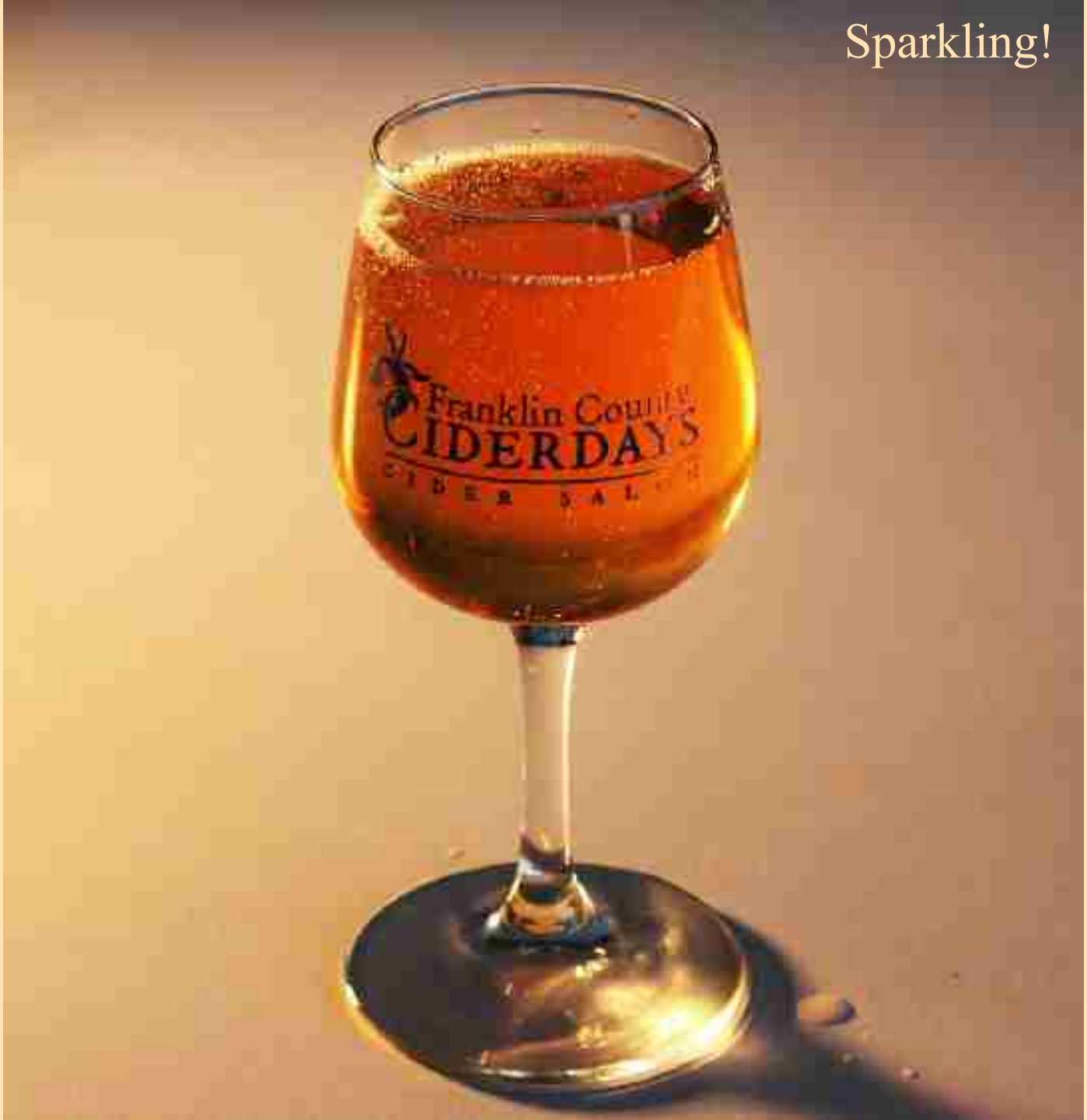
Transformation % of malic acid:	40	%		Total acidity before MLF (malic acid):	6.1	g/l
				Total acidity after MLF:	4.3	g/l
Ratio of alcohol to total SG drop:	127.5	Final SG with MLF:	0.9964	SG variation due to MLF:	-0.0006	

Chapter 15 CIDER DIVERSITY

- Sweetness: dry / medium / sweet.
  - Keeving and other methods to retain residual sweetness.
- Bubbles: still / perlant / petillant / sparkling.
  - Prise de mousse / bottle conditioning / sugar dosage / CO2 tank and forced carbonation.
  - Bottling procedures.
- Ice cider.
  - Methods for obtaining the concentrated juice.
  - Fermentation and stabilization.

Keeving for a naturally sweet cider

Sparkling!



Ice cider - partially thawed apples, ready to press

Chapter 16 CIDER TROUBLES

- Discussions on the main troubles that may affect the cider and when possible, methods to cure.
  - Film yeast
  - Acetification
  - Microbiological faults
  - Clearing issues - fining
  - Sulfur taints

Fining test for a hazy perry

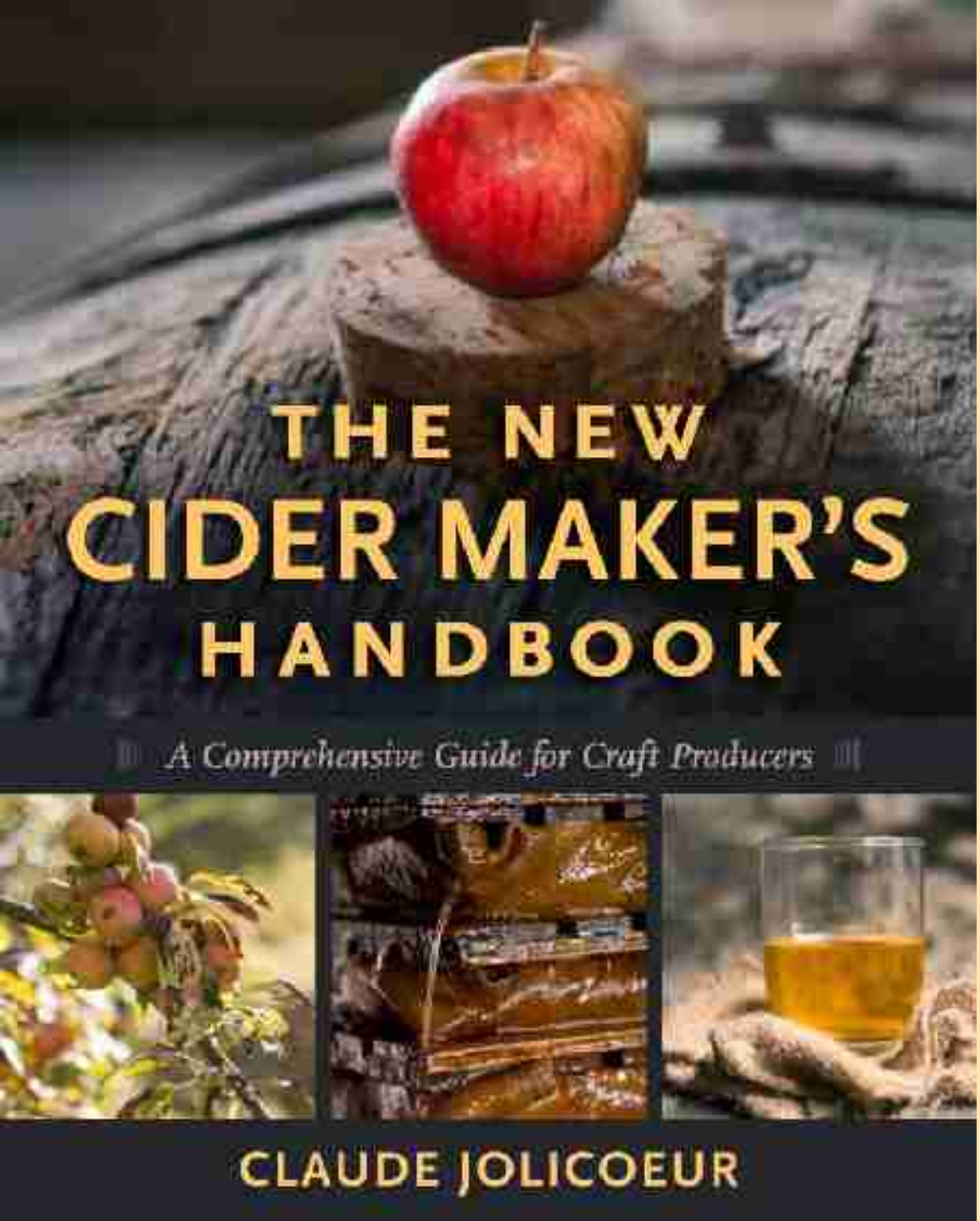
APPENDICES

Appendix 1 Units and Measures

Liters, Gallons, Kg, lb., spoons, cups, concentrations in g/L and ppm, bushels, bins, tons...

Appendix 2 Companion Materials

Excel spreadsheets for hydrometer, blending, monitoring or modeling a fermentation...



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