Comparison of TA testing methods

Manual Titration, HANNA, Sentia

Winemakers Research Exchange, Rebecca Rainbow & Joy Ting, Nov 14, 2024

Goals & Objectives

1. To validate Sentia wine analyzer TA based on:

- Accuracy & precision for juice and wine over a range of values

- Ease of use and probability of error

- Cost (initial and ongoing)

2. To assist winemakers in finding manageable solutions for in-house analysis

**some graphs in this presentation have data from a fourth refractometer method, but this is less relevant for production winemakers*

Samples Tested

Juice & Wine, White & Red, High & Low

Juice	**Color**	**Imbibe (g/L)**
Fifty Third Chardonnay	White	4.66
Septenary Chardonnay	White	5.04
Fifty Third Chambourcin	Red	8.48
Hark Petit Manseng	White	19.03
Wine		**ETS (g/L)**
King Family Petit Verdot	Red	4.7
Potomac Point Petit Manseng	White	6.5
King Family Chardonnay	White	7.4
Fabbiolo Chambourcin	Red	8.2

Testing Setup

- Samples were aliquoted and assigned random numbers

- Two samples of each juice/wine were tested each day on two separate days.

- Sample order was randomized for each testing run.

- Sample prep:
  - Juice was boiled prior to testing to inhibit fermentation and de-gas, then cooled overnight

  - All samples shaken for 30 seconds prior to testing (to de-gas)

Methodology

Manual Titration

- pH meter calibrated, tested against Franzia and KHT standards
- NaOH was within 30 days of opening
- Used DI water uncorrected (validated methodology in initial round)

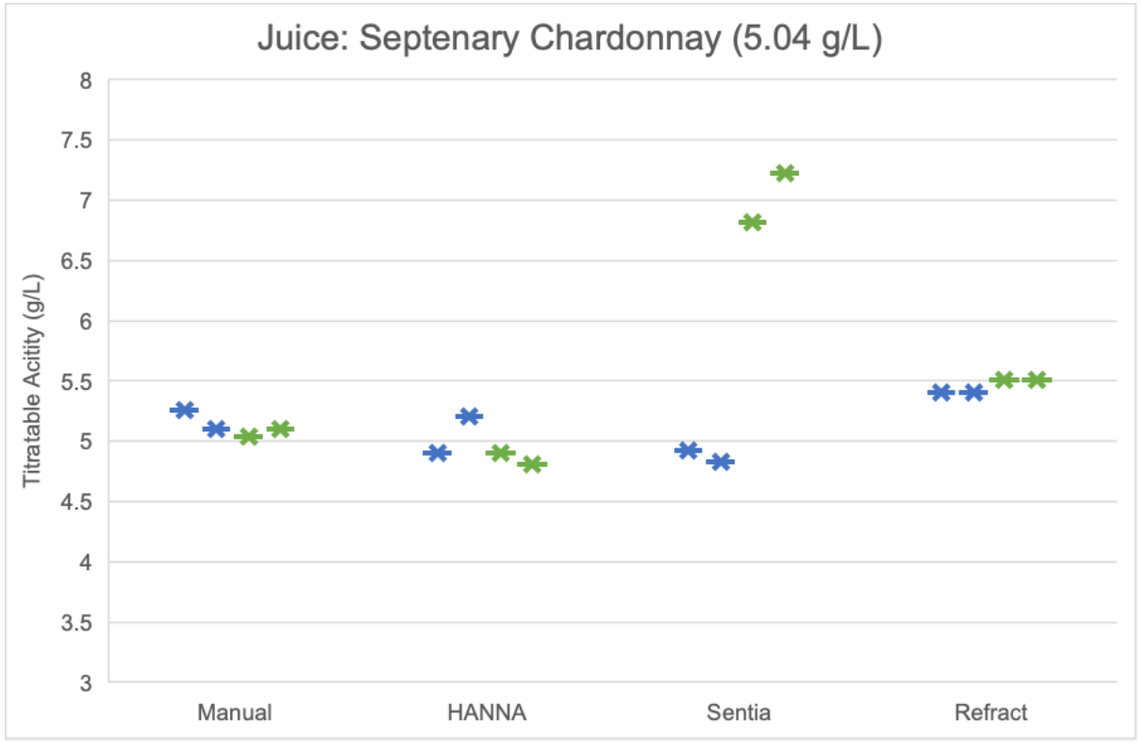
HANNA

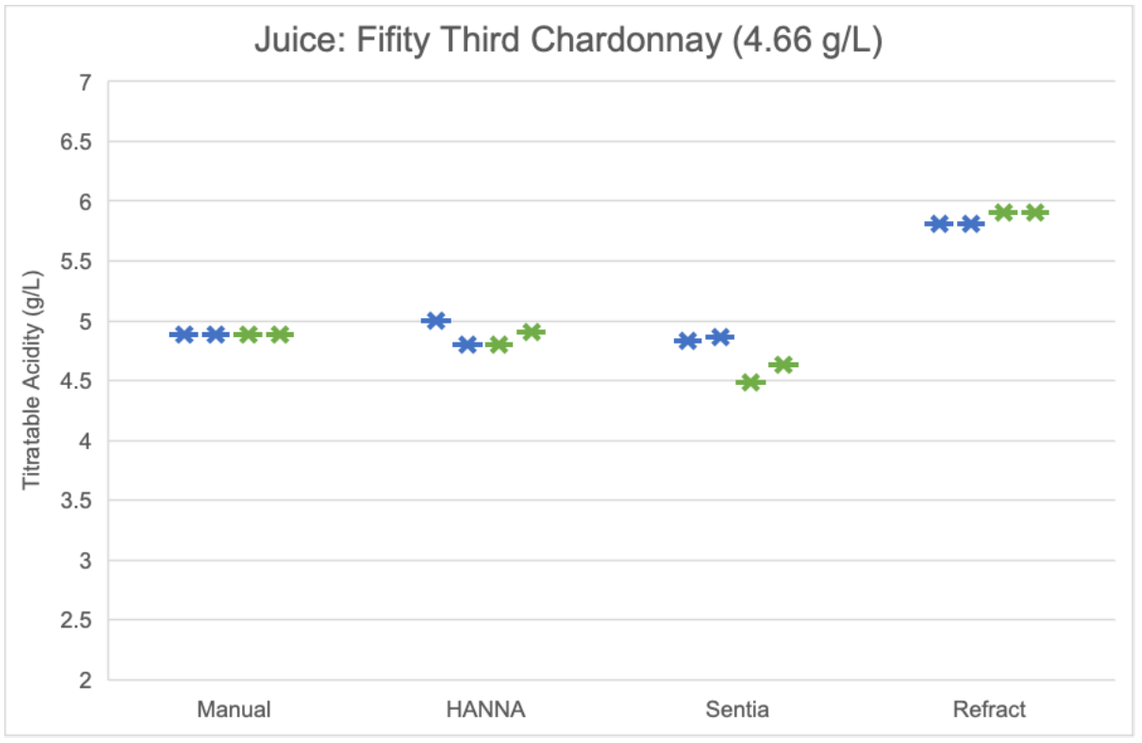
- pH calibrated to 7.0 and 8.2 standards
- Used fresh calibration standard

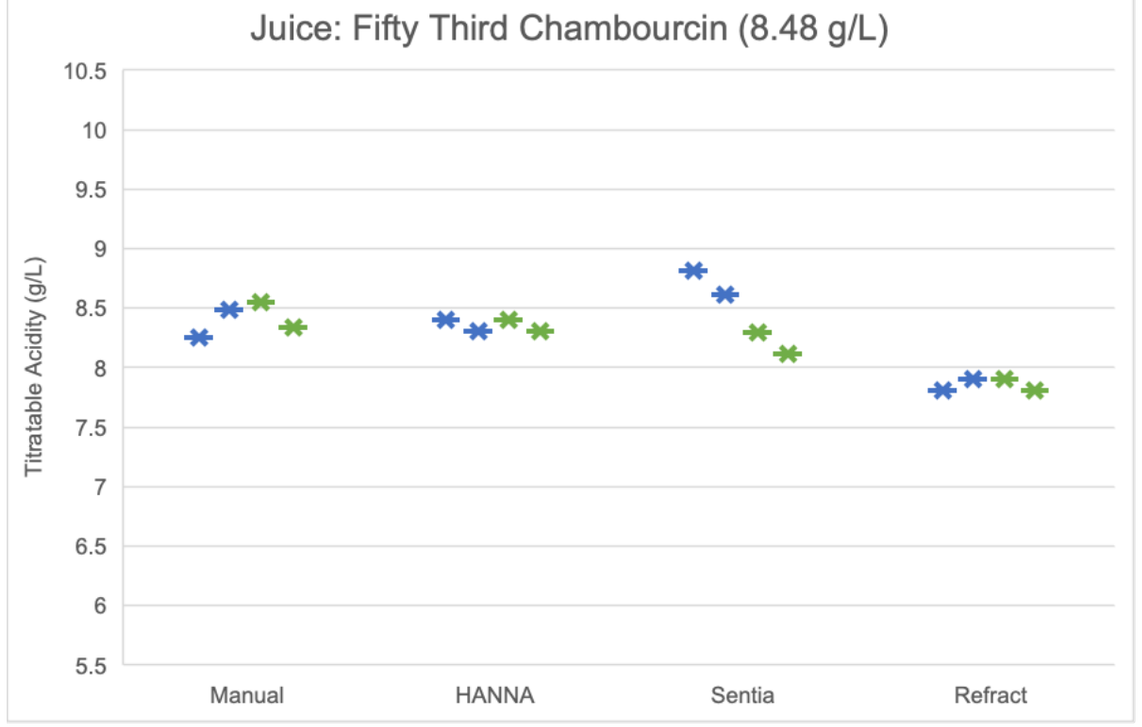
Sentia

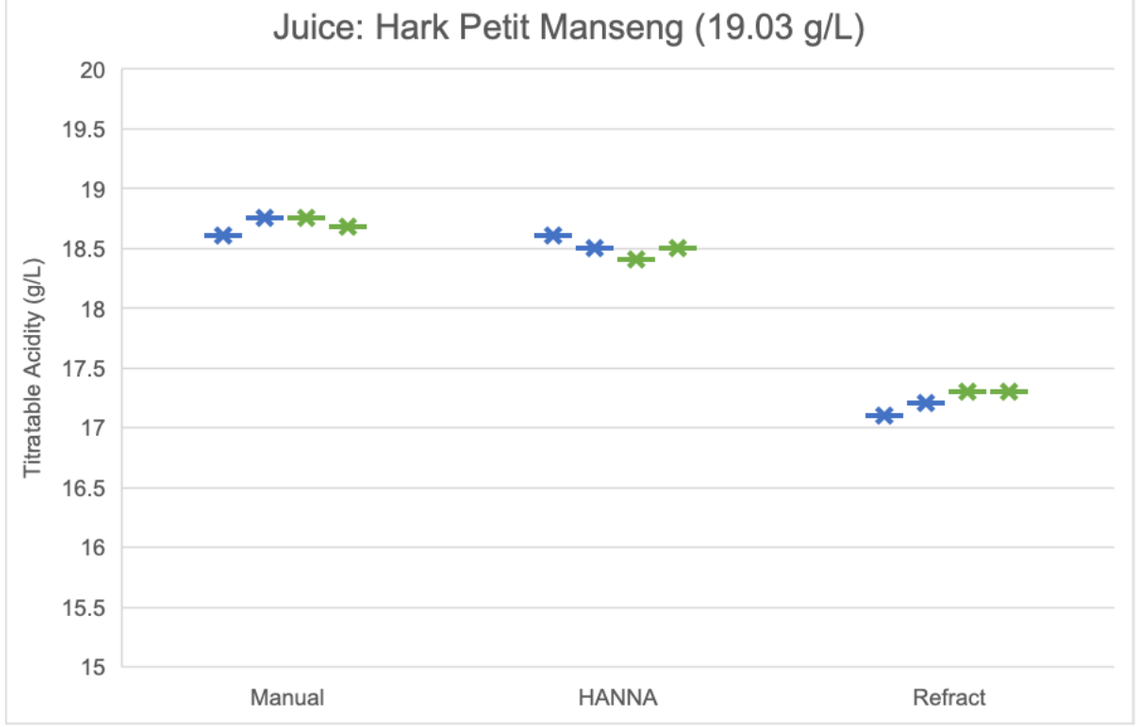
- Juice samples must be filtered or centrifuged to clarify, wine samples can be tested directly.
  - Used small tabletop centrifuge (1.5 mL tubes)
- MUST be degassed

Juice		53rd Chardonnay	Septenary Chardonnay	53rd Chambourcin	Hark Petit Manseng
	Lab	4.66	5.04	8.48	19.03
Manual Titration	Mean	4.9	5.1	8.4	18.7
	Range	4.88	5.03 - 5.25	8.25 - 8.55	18.6 - 18.75
	SD	0.000	0.093	0.137	0.071
	CV	0.000	0.018	0.016	0.004
HANNA	Mean	4.9	5.0	8.4	18.5
	Range	4.8 - 5	4.8 - 5.2	8.3 - 8.4	18.4 - 18.6
	SD	0.096	0.173	0.058	0.082
	CV	0.020	0.035	0.007	0.004
Sentia	Mean	4.7	5.9	8.5	>10
	Range	4.48 - 4.83	4.83 - 7.22	8.11 - 8.81	n/a
	SD	0.179	1.247	0.314	n/a
	CV	0.038	0.210	0.037	n/a

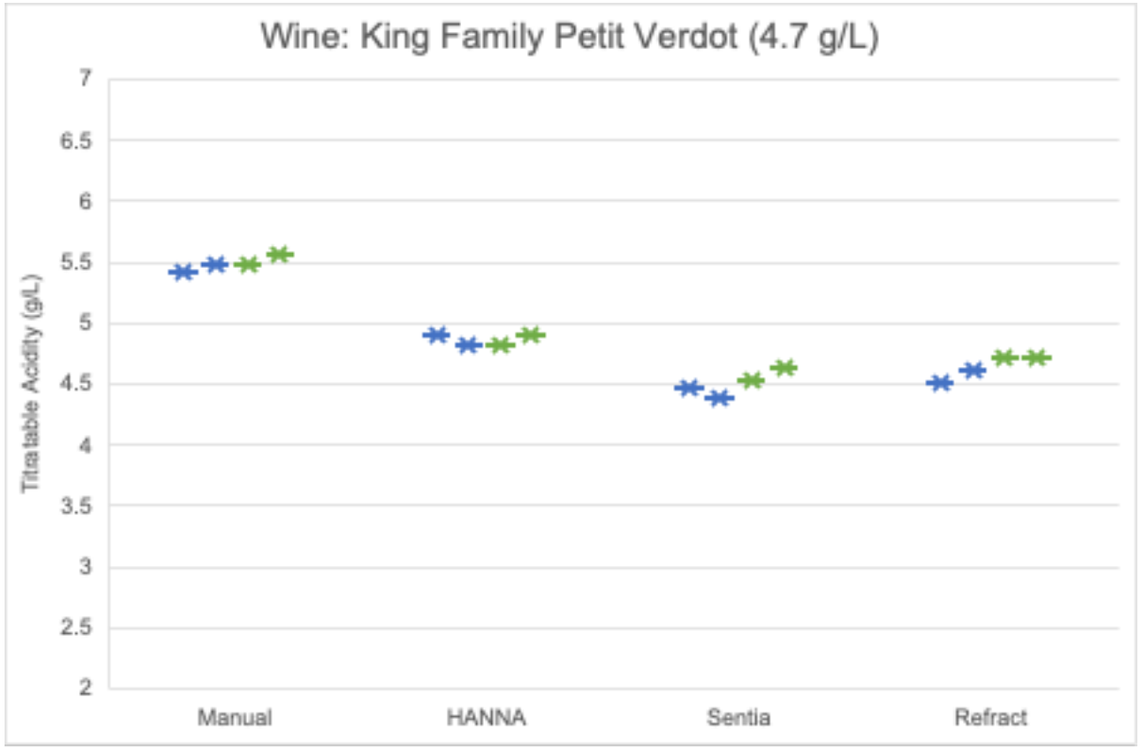

Juice: Septenary Chardonnay (5.04 g/L)
Titratable Acitity (g/L)
8
7.5
7
6.5
6
5.5
5
4.5
4
3.5
3
Manual
HANNA
Sentia
Refract

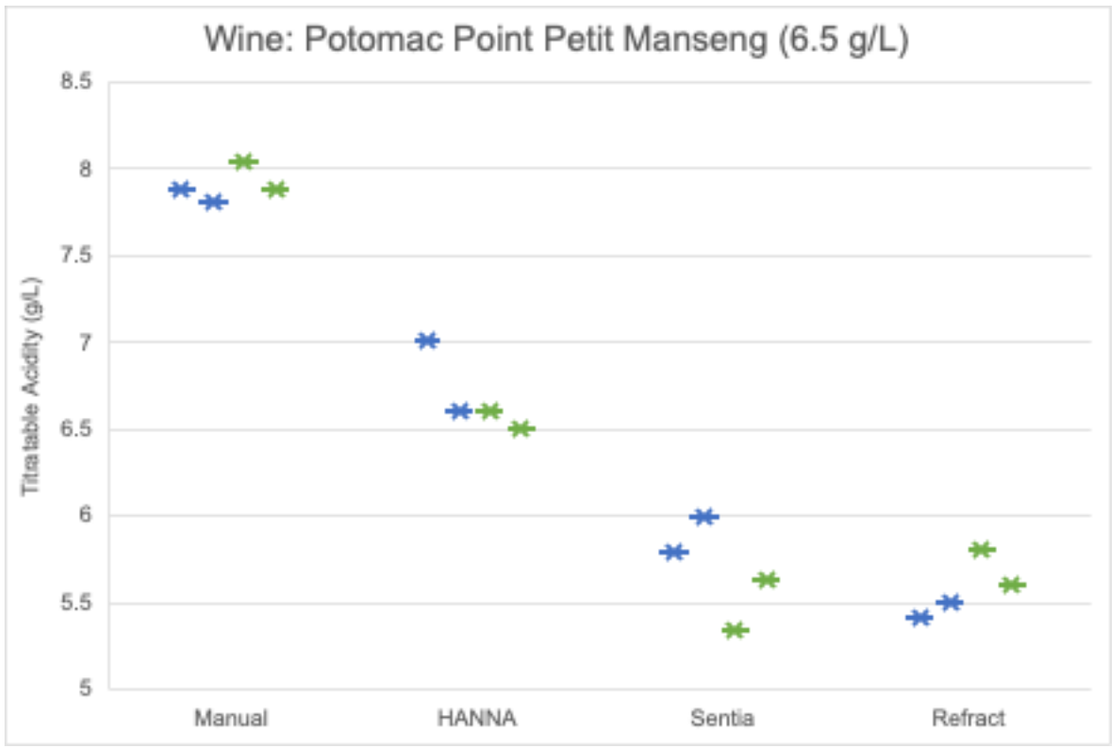

Juice: Fifity Third Chardonnay (4.66 g/L)
Titratable Acidity (g/L)
7
6.5
6
5.5
5
4.5
4
3.5
3
2.5
2
Manual
HANNA
Sentia
Refract

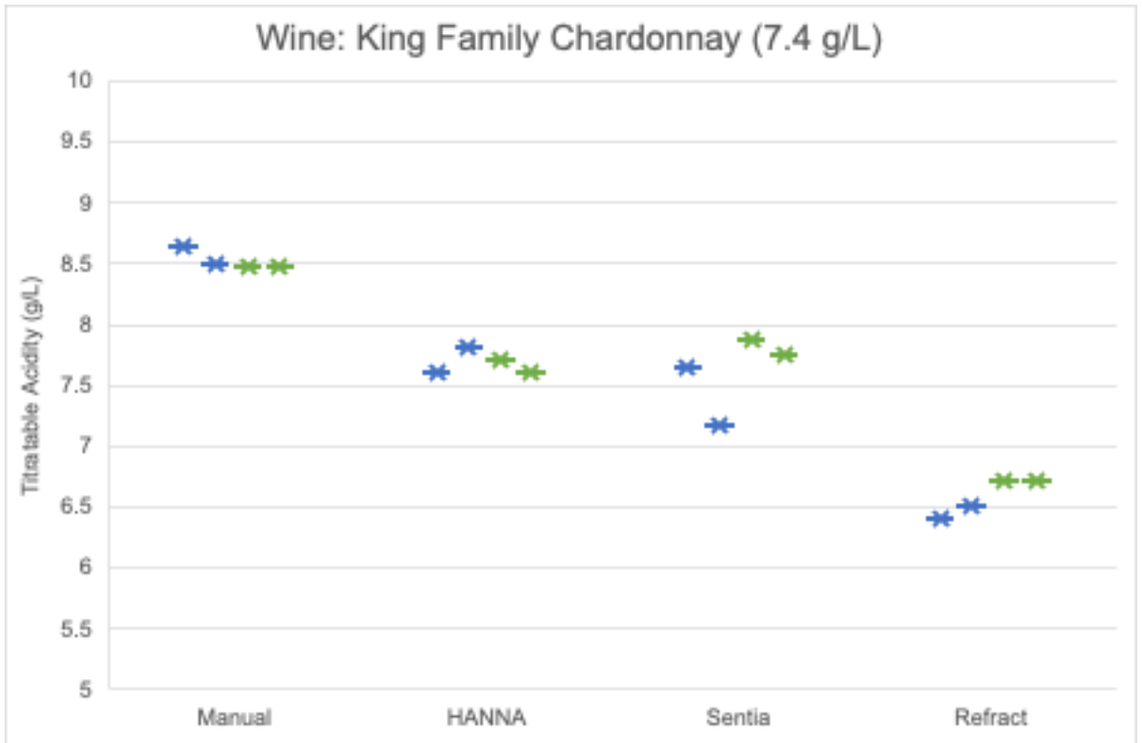

Juice: Fifty Third Chambourcin (8.48 g/L)
Titratable Acidity (g/L)
10.5
10
9.5
9
8.5
8
7.5
7
6.5
6
5.5
Manual
HANNA
Sentia
Refract

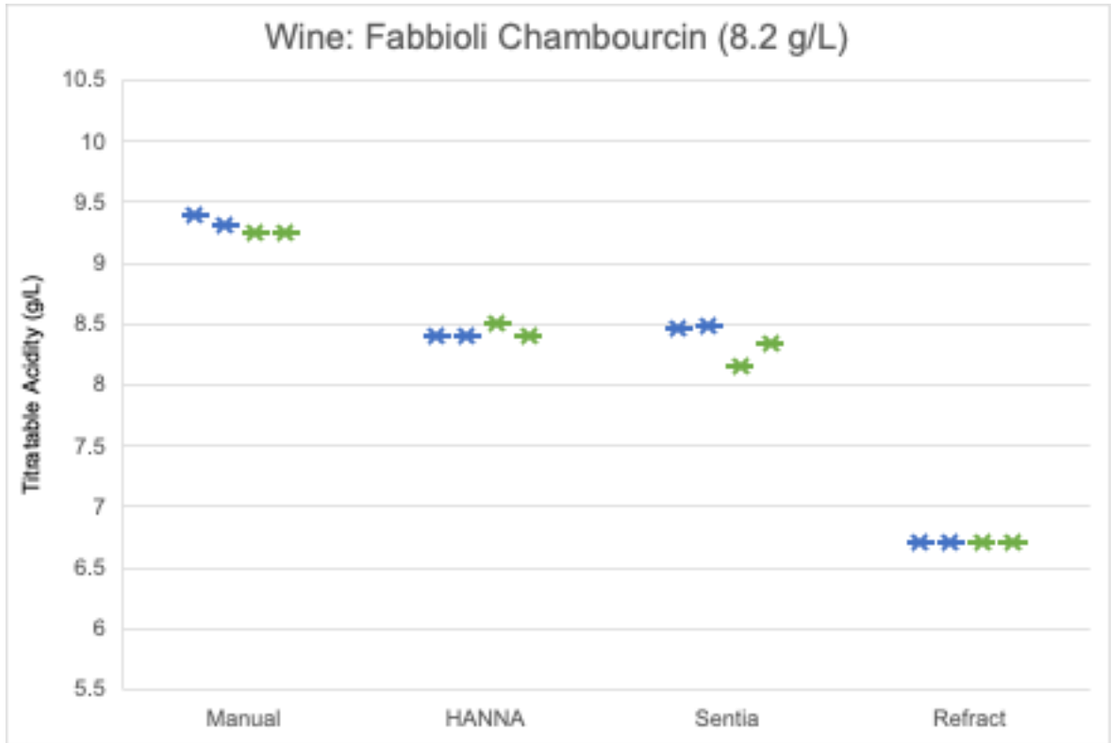

Juice: Hark Petit Manseng (19.03 g/L)
Titratable Acidity (g/L)
20
19.5
19
18.5
18
17.5
17
16.5
16
15.5
15
Manual
HANNA
Refract

Wine		King Family Petit Verdot	Potomac Point Petit Manseng	King Family Chardonnay	Fabbioli Chambourcin
	Lab	4.7	6.5	7.4	8.2
Manual Titration	Mean	5.5	7.9	8.5	9.3
	Range	5.48 - 5.55	7.8 - 8.03	8.47-8.63	9.23 - 9.38
	SD	0.061	0.097	0.078	0.071
	CV	0.011	0.012	0.009	0.008
HANNA	Mean	4.9	6.7	7.7	8.4
	Range	4.8 - 4.9	6.5 - 7.0	7.6 - 7.8	8.4 - 8.5
	SD	0.058	0.222	0.096	0.050
	CV	0.012	0.033	0.012	0.006
Sentia	Mean	4.5	5.7	7.6	8.4
	Range	4.38 - 4.62	5.33 - 5.99	7.17 - 7.84	8.14 - 8.48
	SD	0.102	0.279	0.305	0.156
	CV	0.023	0.049	0.040	0.019


Wine: King Family Petit Verdot (4.7 g/L)
Titratable Acidity (g/L)
7
6.5
6
5.5
5
4.5
4
3.5
3
2.5
2
Manual
HANNA
Sentia
Refract

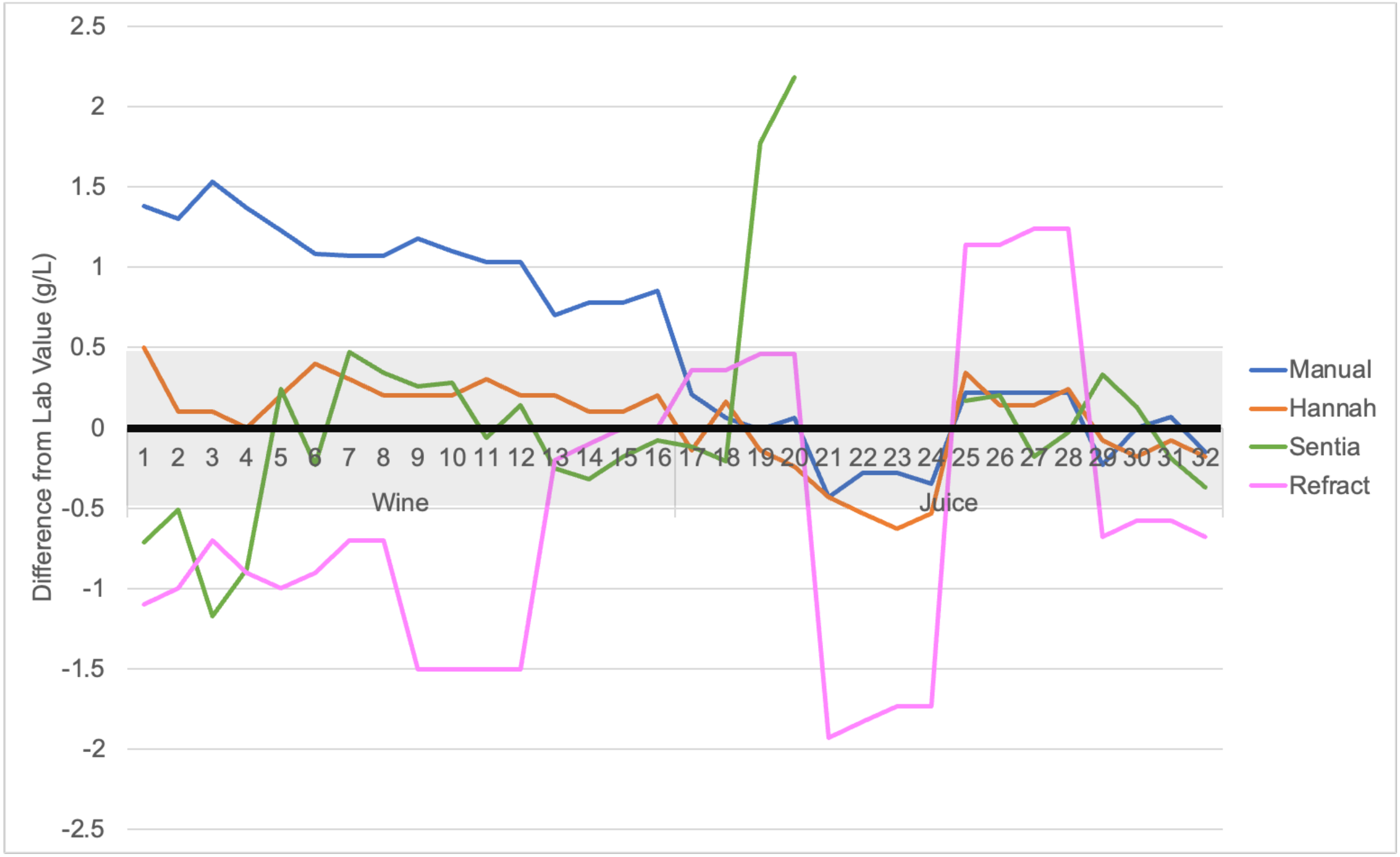

Wine: Potomac Point Petit Manseng (6.5 g/L)
Titratable Acidity (g/L)
8.5
8
7.5
7
6.5
6
5.5
5
Manual
HANNA
Sentia
Refract


Wine: King Family Chardonnay (7.4 g/L)
Titratable Acidity (g/L)
10
9.5
9
8.5
8
7.5
7
6.5
6
5.5
5
Manual
HANNA
Sentia
Refract


Wine: Fabbioli Chambourcin (8.2 g/L)
Titratable Acidity (g/L)
10.5
10
9.5
9
8.5
8
7.5
7
6.5
6
5.5
Manual
HANNA
Sentia
Refract

Relative Standard Deviation

How different is the sample read from the lab value?



Cost & Ease of Use

	Startup Cost	Cost per test	Limit of detection (g/L)	Time per sample (minutes)	Ease of Use
Manual	$306.00	$1.15		5	Moderate
HANNA	$1,184.97	$1.87	4.0 - 25.0	4	Easy
Sentia	$2,273.50	$7.00	3.0 - 10.00	1	Easy

Manual: time and focus intensive, risk of over titration

HANNA: more time to calibrate, simple after that, allows multitasking

Sentia: requires centrifugation, testing itself is simple

Summary of Results

HANNA titrator had lowest overall deviation from the measured lab value. Sentia had highest deviation of replicate tests, however the average was the closest to the ETS standard.

Coefficient of Variation was similar for manual (0.010) and HANNA (0.016). The Sentia had an average CV of 0.059.

Sentia has highest up front and per test cost than other methods, but it the quickest and most convenient for a reasonable number. HANNA and manual had much larger ranges of sensitivity.

As of 2025, the Sentia sensor technology is the same, however the sample prep and algorithms have been updated, which may lead to even better results