The ValleyVintner™

Using a Refractometer in Place of Hydrometer to Manage Fermentation:

Hydrometer of 250mL vs 2 drops on a Refractometer. Note the eyedropper above the refractometer.

Bubbles during fermentation attach to the hydrometer and skew your reading. Temperature adjustments are also necessary as most hydrometers are calibrated at 60 ^{0}F.

Hydrometers break, are messy, vary due to temperature, fermentation (CO2) and the precision of your tool. Each time I've used a hydrometer I've had to;

1.) Sanitize my hydrometer, beaker and Siphon
2.) Pull 250mL out of my tank,
3.) Carefully insert the hydrometer (I've broken a few in the past)
4.) Spin the hydrometer to knock the bubbles off and try to read the still spinning gradient before the bubbles take hold and skew the reading again.
5.) Then adjust the measurement for temperature as most Hydro's are calibrated to 60 ^{0}F.
6.) Finally return the wine back to the fermenter and hope I didn't introduce too many contaminants into the batch during the analysis.

Multiply this activity 2 times each day and you begin to wish there was an effective alternative.

A refractometer with ATC (Auto Thermal Compensation) is unaffected by temperature, fermentation gases and only takes one to two drops to measure the sugar content of your must. However, it is effected by the different refractive index of ethanol. As the amount of alcohol increases the refractive index changes algorithmically. Unlike a Hydrometer the reading in a refractometer will never go to zero.

With a Refractometer you:

1.) Fill an eye dropper with a couple drops of juice
2.) Drip a drop or two on the refractometer lens
3.) Read the refractive index through the refractometer

In theory the ethanol effect is predictable and a formula should be able to compensate for it's refractive change.

To test the theory we fermented a Zinfandel kit and took measurements with both a professional refractometer and precision hydrometer using a formula from the CRC Handbook of Chemistry and Physics ("Concentrative Properties of Aqueous Solutions: Conversion Tables", 69th Edition Table 88 Sucrose). We then evaluated the correlation between the formula compensated refractometer readings against those from a precision hydrometer from start to finish of fermentation.

We were amazed. The formula tracked like rocket science. Over

the 10 day fermentation we averaged less than 1% difference and that falls into the realm of user error.

Check our test results and download the file for your own use!

During our experiment we pulled 5750mL (1.5 Gallons) for the twice daily hydrometer readings. Compare to the 10ml of juice at right for a refractometer. Note that the small samples for the refractometer are not reintroduced back into the fermenter. Greatly reducing risk of contamination.

Experiment results (.pdf)

Spread sheet to auto compensate for ethanol effect on a refractometer during fermentation (.xls Requires MSN Excel).

Formula for compensation of ethanol effect on refractometer:
SG=1.001843-0.002318474(OB)-0.000007775(OB^2)-0.000000034(OB^3)+0.00574(AB) +0.00003344(AB^2) +0.000000086(AB^3)

SG = Specific Gravity, OB = Original Brix, AB = Actual Brix (Brix Readings During Fermentation)

Formula to convert from SG to Brix (for those who prefer Brix measurements):
Brix (Plato) = -676.67 + 1286.4*SG - 800.47*(SG^2) + 190.74*(SG^3)

Temperature compensation formula for hydrometers calibrated at 60ºF:
Correction = 1.313454 - 0.132674*F + 0.002057793*(F^2) - 0.000002627634*(F^3)
SG corrected = SG + (correction * 0.001)