

# FINAL GRAVITY

---

BUTLER COUNTY BREWING SOCIETY

# FINAL GRAVITY: WHAT IS IT?

---

- After fermentation is complete, the 'final gravity' is the density or specific gravity of the finished beer.
- The final gravity can be measured by:
  - A hydrometer – make temperature corrections as needed (chart)
  - A refractometer – make corrections for the presence of ethanol (math)

# FINAL GRAVITY: WHY DO WE CARE?

---

- The difference between the original gravity (density of the wort at the beginning of fermentation) and the final gravity will tell us important outcomes.
  - Data: The ABV of the beer
  - Data: The apparent attenuation of the yeast
- In a broad sense, the final gravity is telling you much more...

# FINAL GRAVITY: WHAT IT'S TELLING US

---

| Lower Final Gravity  | Characteristic   | Higher Final Gravity |
|----------------------|------------------|----------------------|
| Thinner, more watery | BODY / MOUTHFEEL | Fuller, thicker      |
| Dryer                | FINISH           | Malty, Sweeter       |

| Lower Final Gravity | Recipe & Process           | Higher Final Gravity |
|---------------------|----------------------------|----------------------|
| Happy yeast         | Yeast Apparent Attenuation | Not-so Happy yeast   |
| Below average       | % Unfermentable Sugar      | Above average        |
| Above target        | Fermentation Temperature   | Below target         |
| -                   | pH (especially mead/wine)  | Too high/low         |

LOOKING AT THIS INFORMATION, WHAT DO YOU THINK ARE IMPORTANT FACTORS DRIVING “FG”?

---

| Lower Final Gravity  | Characteristic   | Higher Final Gravity |
|----------------------|------------------|----------------------|
| Thinner, more watery | BODY / MOUTHFEEL | Fuller, thicker      |
| Dryer                | FINISH           | Malty, Sweeter       |

| Lower Final Gravity | Recipe & Process           | Higher Final Gravity |
|---------------------|----------------------------|----------------------|
| Happy yeast         | Yeast Apparent Attenuation | Not-so Happy yeast   |
| Below average       | % Unfermentable Sugar      | Above average        |

USE YOUR WORDS!!!



# F'NG FG FACTORS

---



# RECIPE – GRAIN SELECTION

---

The GRAIN you are using may generate more or less fermentable sugars.

The EXTRACT you use may contain more or less fermentable sugars.

- Base grains are almost exclusively able to make fermentable sugar
- Crystal and roasted malts will have varying degrees of fermentable sugar
  - RULE OF THUMB: As the color of the grain increases/darkens, it's going to generate fewer fermentable sugars in the wort.
- 10-20L grains contribute mostly fermentable sugar; 200+ not so much

Fermentable



Not so much



# RECIPE – GRAIN SELECTION

---

By the way, soluble sugar and fermentable sugar are not the same thing.

- Can I dissolve table sugar in water? YES. Will that sugar ferment? YES.
- Can I dissolve lactose (milk sugar) in water? YES. Will that sugar ferment? UM
  - If you are using an aggressive strain of bacteria, YES.
  - If you are using normal beer yeast and you don't have an infection, NO!



# RECIPE – ADJUNCT SELECTION

---

ADJUNCTS are most often used to drive FG one way or the other:

| Adjunct      | Reason(s) to Use                                      | Moves FG Which Way? |
|--------------|-------------------------------------------------------|---------------------|
| Table Sugar  | Adds alcohol, thins body, dries out the finish        | DOWN                |
| Honey        | Same as table sugar plus can leave some aromatics     | DOWN                |
| Light DME    | (to a big stout) Adds alcohol, can thin a beer's body | DOWN (a little)     |
| Flaked Grain | Adds body and mouthfeel (think oatmeal stout)         | UP (a little)       |
| Lactose      | Adds milk-like sweetness and a little body            | UP                  |
| Molasses     | Adds dark sugar and rum flavor, sweetens the finish   | UP                  |

# GRAIN/ADJUNCT SELECTION IMPACT ON GRAVITY

---

## BELGIAN TRIPEL

- 13 lbs Belgian Pilsner/Munich/Wheat
- 1.5 lbs Sugar/Honey
- 0.25 lbs Aromatic 20L
- OG = 1.076
- FG = 1.006

## BELGIAN DARK STRONG

- 13.5 lbs Belgian Pilsner/Munich/Wheat
- 1.5 lbs Sugar/Amber Candi Syrup
- ~3.0 lbs Aromatic/CaraMunich/Special B
- OG = 1.088 (+12 points)
- FG = 1.016 (+10 points)

# PROCESS – MASH REST TEMPERATURES

---

For all-grain brewing, you have one or more TEMPERATURE rests during the MASH. There are two different enzymes that break the starch down into sugars.

- Alpha Amylase: 140F – 168F (chunk sugars from starch)
- Beta Amylase: 130F – 150F (one maltose from starch/sugars)

A mash temperature around 150-153F for one hour tends to be the sweet spot for most beers to create a fermentable wort. Mashing the entire hour at 140-146F will make a very fermentable beer (lower FG). Mashing at 158-164F on the other hand would create a lot of large sugars that would be difficult for most yeast to ferment (higher FG).



# RECIPE – YEAST SELECTION

---

Every strain of YEAST has a typical range of attenuation, or degree to which it will ferment out the wort.

- White Labs WLP500 Monastery Ale      75-80% apparent attenuation
- Wyeast 1099 Whitbread Ale      68-72% apparent attenuation
- Wyeast 1028 London Ale      73-77% apparent attenuation
- White Labs WLP650 Brett Brux      70-85% apparent attenuation



# PROCESS – FERMENTATION TEMPERATURES

---

One of the variables that plays into the yeast manufacturer's estimated attenuation numbers is the temperature of fermentation. In general, lower fermentation temperatures drive a slower fermentation and warmer temperatures drive a slightly faster fermentation.

A really low fermentation temperature below the preferred range of a yeast may cause the yeast to stall pre-maturely, leaving the FG high. You'll often see posts about the fix for this – move the fermenter to a warmer spot and (if you dare) rouse the yeast with a sanitized spoon **VERY GENTLY**. Worst case, toss in a hungrier yeast to finish it off.





# PROCESS – YEAST HEALTH

---

From the yeast discussions, we talked about several things that can help yeast be healthy, wealthy and wise to start fermentation. Healthy yeast do their job – lots of really healthy yeast can be over efficient and vice versa:

- Pitch Rate: Always pitch a lot of healthy, active yeast – use the rate calculator
- Oxygenation: Yeast need O<sub>2</sub> at the beginning of the lag phase to reproduce

Get in a habit for these two items – that will remove this as a problem area as it pertains to hitting your FG.



# OTHERS

---

pH – can be a big deal on wine, mead and cider. Low or High pH can stall the yeast or be an indicator of an imbalance in the fermenter.

Grain staling – old ingredients don't do good things to your beer. Keep your extra ingredients stored properly or buy fresh. Base grain is pretty cheap.

The BOIL – if you boil your wort full blast for a long time, you will caramelize a lot of sugars and can render a portion of the wort unfermentable (wee heavy).

