

- Fermentation and temperature



A decorative graphic on the left side of the slide. It features a thick, flowing stream of golden liquid, possibly beer, pouring downwards. In the background, there are two glasses filled with beer, showing bubbles and condensation. The overall style is clean and modern, with a light gray background and a white border.

What we will do

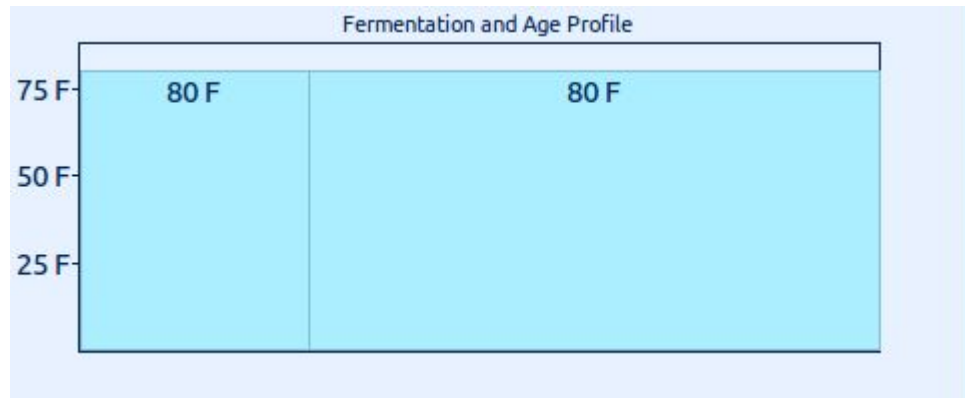
- Can we taste the difference?
- Why does temperature matter?
- Example of temperature control
- How to build a simple, active cooler

*Controlling temp matters
It is not that hard or expensive*

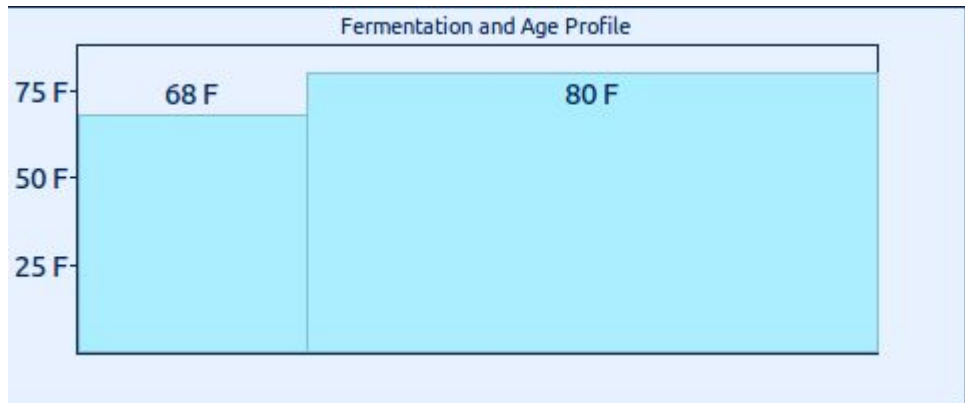
The difference

4 days, 12 degrees difference

1



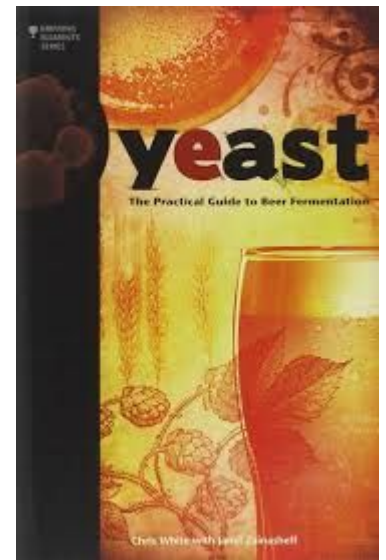
2



Does temperature matter?

One of the greatest things a brewer can do to improve his beer is manage the fermentation temperature. This is far more important than using fancy fermenters or even all-grain brewing.

...yeast cells produce most of their fermentation flavor compounds in the first 72 hours




WLP001

Compound	Perception Threshold	66° F (19° C)	75° F (24° C)
Ethanol	1.4% ABV	4.74% ABV	5.04% ABV
1-Propanol	600 ppm	23.78 ppm	22.76 ppm
Ethyl acetate	30 ppm	22.51 ppm	33.45 ppm
Isoamyl alcohol	70 ppm	108.43 ppm	114.92 ppm
Total diacetyl	150 ppb	7.46 ppb	8.23 ppb
Total 2,3-pentanedione	900 ppb	5.09 ppb	3.17 ppb
Acetaldehyde	10 ppm	7.98 ppm	152.19 ppm

The main flavor difference was a substantial increase in acetaldehyde, 10.5 times higher than the perception threshold.





Gross generalization

Warmer = More

- Esters: Warmer => More
 - Isoamyl acetate - Banana
 - Ethyl caprylate- apples, pears, or anise
- Fusel alcohols: Warmer => More
 - Solvent, nailpolish remover
- Phenols: more complicated...
 - 4-Vinyl guaiacol - clove
 - And yes warmer => more, but other factors play in.

More flavor or good flavor?

A decorative graphic on the left side of the slide. It features a thick, golden-yellow liquid splash or stream flowing downwards. In the background, there are two glasses of beer. The glass in the foreground is a tall, slender one, filled with golden beer and topped with a thick layer of white foam. The glass behind it is shorter and wider. Both glasses are covered in condensation droplets. The background also has a pattern of small, light grey dots.

More on fermentation

- ✓ **Jim's The Art of Fermentation**
 - ✓ <http://www.sudzers.org/wp-content/uploads/2014/06/The-Art-of-Fermentation.pdf>

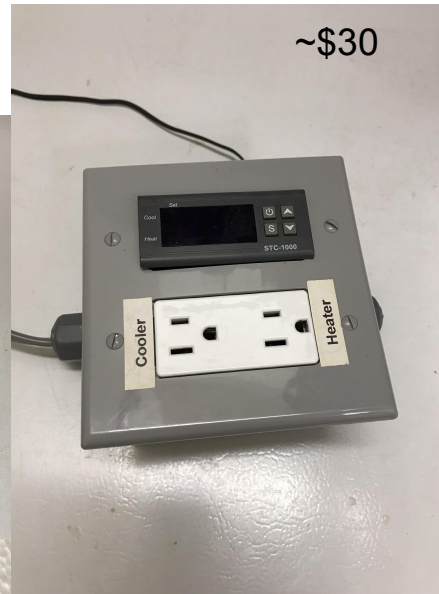
A decorative graphic on the left side of the slide. It features a thick, flowing stream of golden liquid, possibly beer, cascading down. In the background, there are two glasses filled with beer, topped with white foam. The entire graphic is adorned with numerous small, realistic-looking bubbles. The background of the slide is white with a subtle pattern of small grey dots.

What you need

- Temperature controller
- Heater and/or Cooler

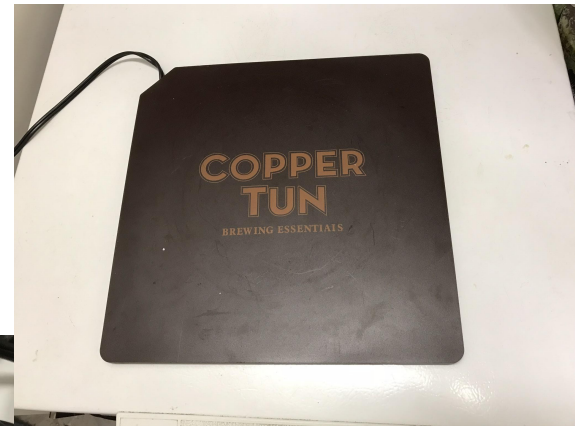
Temperature controller

- Single or double relay (hot / cold)
- Ready made or DYIO
- Power (Volts and Amps)
- Cost



Heaters

- Heat strips (\$30 Moorebeer)
- Heat pads (\$40)
- Reptile heaters (\$15)
- Seedling mats (\$15)



Coolers

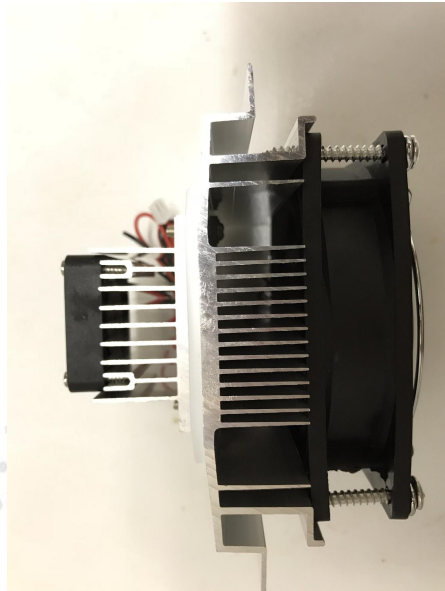
- Refrigerator / Chest freezer
- Son of a Fermentation, Ice with fan
- Peltier coolers
- BrewJacket (\$300)



Controlled coolers and in a reasonable price range

Partslist for a simple cooler

- Peltier Cooler \$20 at Amazon
- Power supply 12V/10A \$15 at Amazon
- Temperature controller \$7 at Amazon
- Styrofoam container
 - Free when you order your Omaha steaks ☐
 - Foam board ~\$20 at Home Depot
 - See Son of Fermentation Chiller
 - Some glue, paint, old lids...



Build it,

- Keep it simple!
- Cut a tight hole for cooler element and push it in.
- Connect temperature controller
- Plug-in
- Ferment!

Experience after 100+ beer fermented

- Paint the inside, spill happens
- Lift up with feet (like lids) to dry condensation
- Use 12V thermocontroller, powersupplies are nasty to 110V relays, and 110V is nasty to you
- You can mount the cooler with a board or screws, but not required
- 60W -> 20F
- Need more? You can have it.
- Be creative, be flexible, build your fermenter collection

