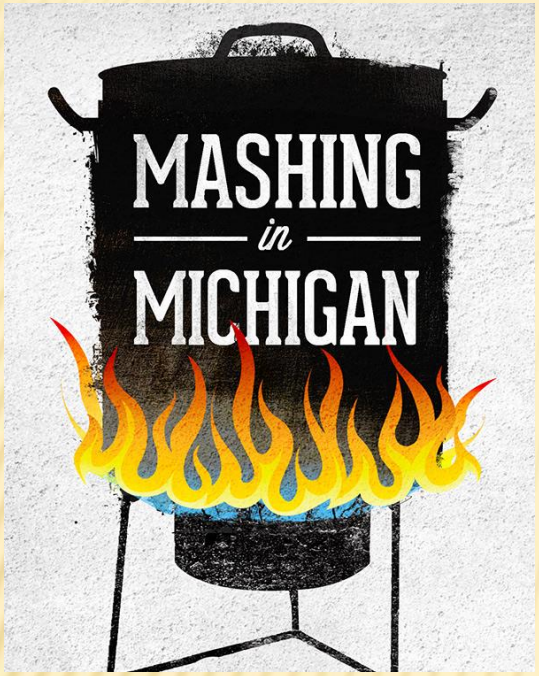
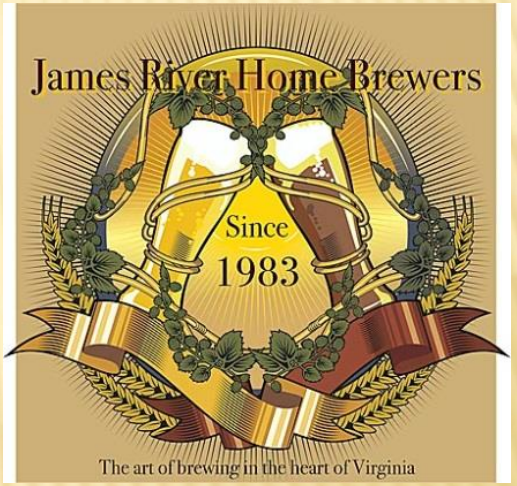




2014 National Homebrew Conference

"Mashing in Michigan"

DEBUNKING THE DETESTED DECOCTION

John Van Itallie
James River Home Brewers

YOU NEVER NEED TO DO A DECOCTION

“YOU NEVER NEED TO DO A DECOCTION”

- So, what am I doing here?
- We will revisit this statement…

IMPORTANT STUFF FIRST:

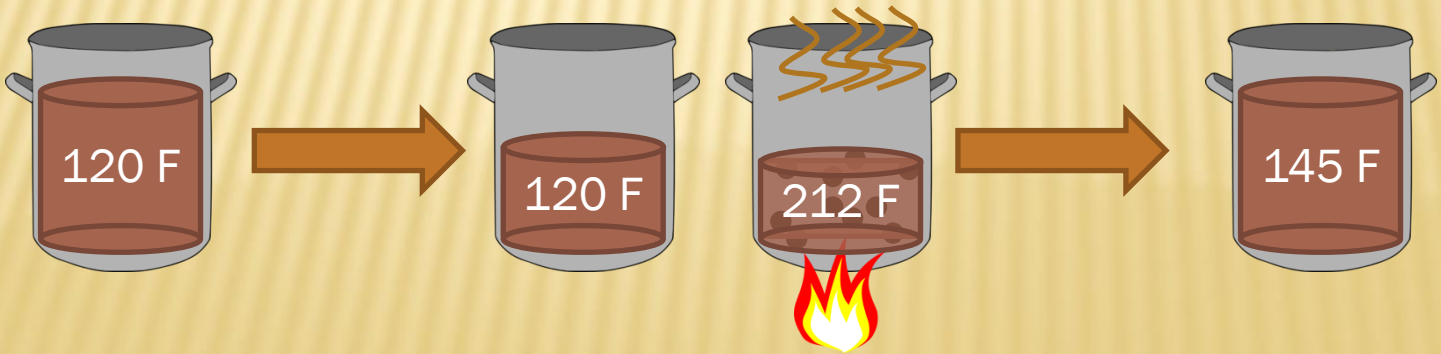
- Time Devastator Dopplebock
  - 60% Munich; 35% Pilsner; 5% Carafa
  - Minimal Noble Hops
  - Traditional Triple Decoction
- Skunky Monkey Hefeweizen
  - 70% Wheat; 30% Pilsner
  - Minimal Noble Hops
  - “Crazy Banana” Decoction Schedule

I’ve heard folks complain of these Decoction things, but what is it???

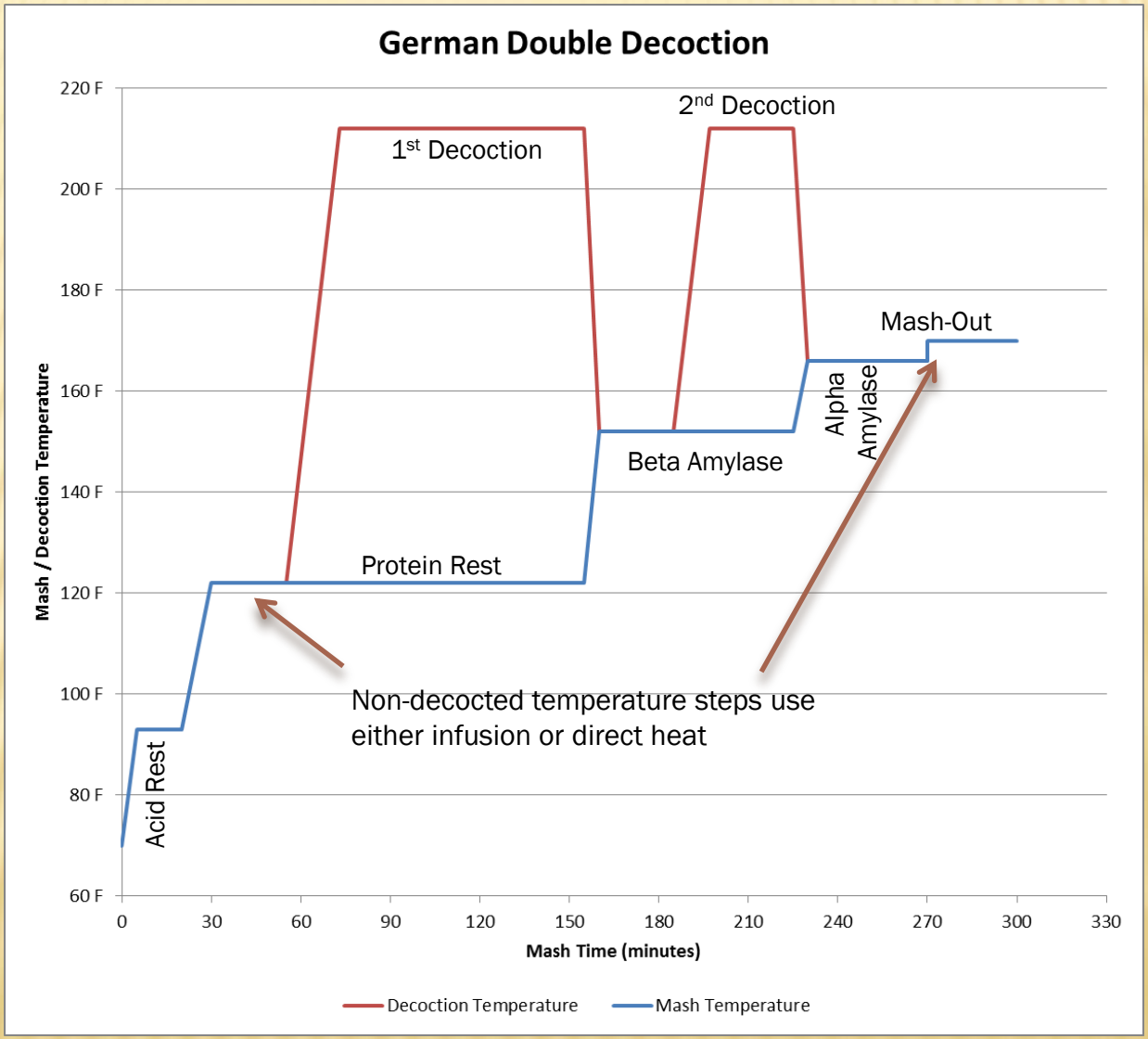
SLOW DOWN!

BASIC DECOCTION PROCESS

- A decoction is performed when you remove a portion of the mash, heat it (usually to boiling), and return it to the mash.
- Purpose:
  - Produce various temperature steps in the mash.
  - Create complex melanoidin flavors.

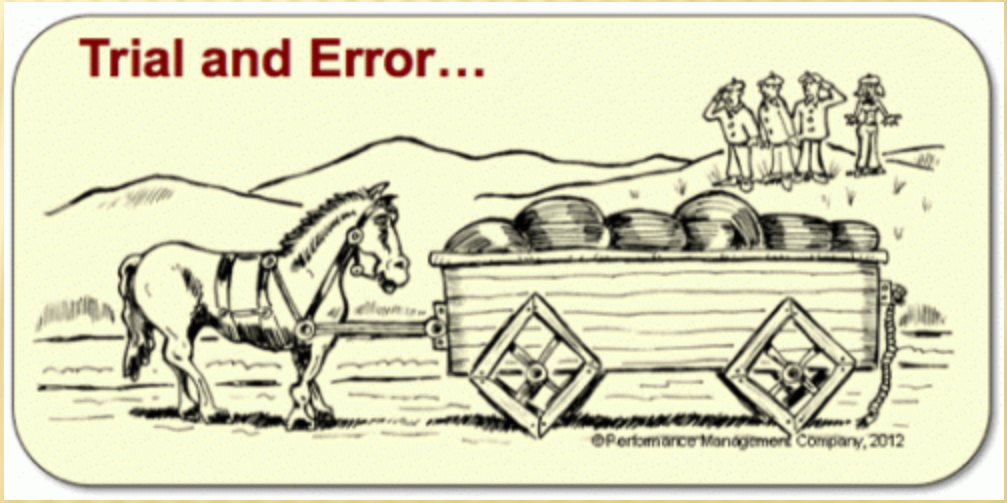


BASIC DECOCTION PROCESS



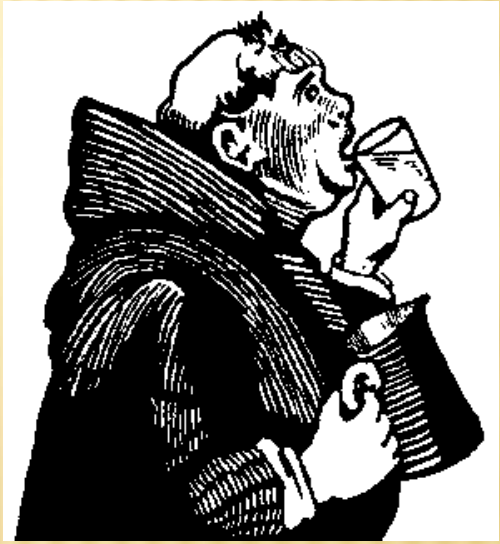
HISTORY

- It is generally accepted that Decoction mashing came about because:
  - Thermometers didn't exist
    - Decoction process = Repeatability.
  - Malts were poorly modified and required multiple mash steps
    - Trial and error before perfecting best decoction process.



HISTORY

- However, this process was really optimized in and around Germany and continued well into modern times
  - Reinheitsgebot influence
    - Acid rests
    - Complex malt flavors not achievable with adjunct



ANOTHER METHOD (MRS. CARY'S GOOD ALE)

Take 3 Bushels malt 1/2 high & 1/2 Pail dry'd **let your water boil then & put into your Mashing tubb, When the Steem is gone off, so as you may see your face**; then put your malt, & after mashing it well then cover it with a blanket, Let it stand 2 hours, then draw it off Slow, then boil it three or four hours, till the hops curdles when boiled Enough, cool a little, & work that with your yest, & so put the rest of your wort in as it cools, which must be let in small Tubs, let it work till your yest begins to curdle then turn it up & stop your Barrel when it has done working; Note to Every Bushels malt a Quarter of pound of hops

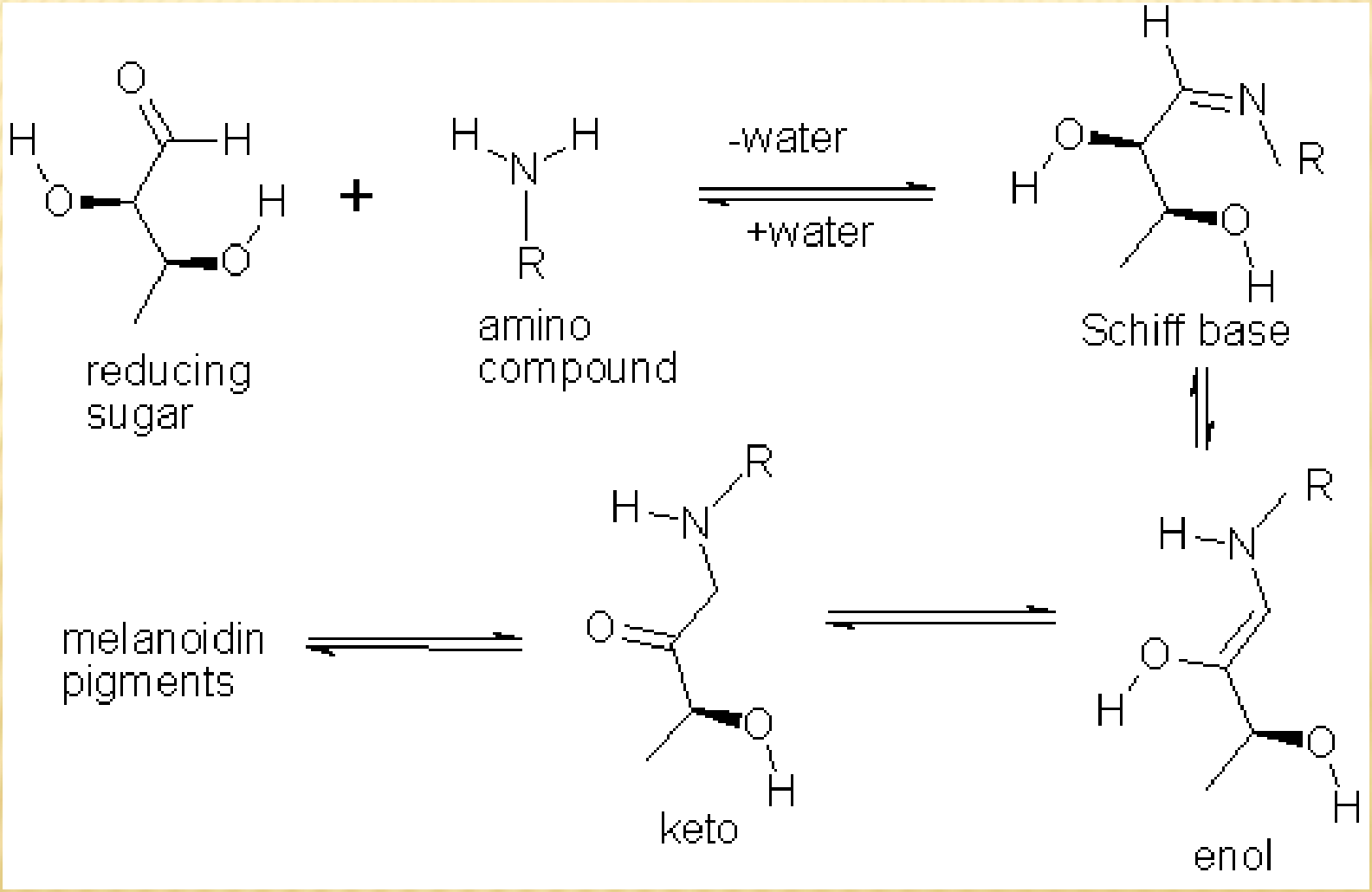
Hope that beer is getting passed around by now…

TIME FOR CHEMISTRY

MAILLARD REACTIONS

- Louis Camille Maillard
  - b.1878 – d.1936
  - French Physician and Chemist
- Described the very important browning reactions responsible for the flavors of Coffee and Chocolate called the “Maillard reactions”

MAILLARD REACTIONS



MAILLARD REACTIONS

- Maillard reactions involves non-enzymatic browning. Will form at temperatures up to around 165 C (329 F). Can happen at room temperature, but more happens the hotter you are.
- Above 165 C, caramelization and pyrolysis will occur.
  - Essentially, the molecules “fall apart” during pyrolysis.

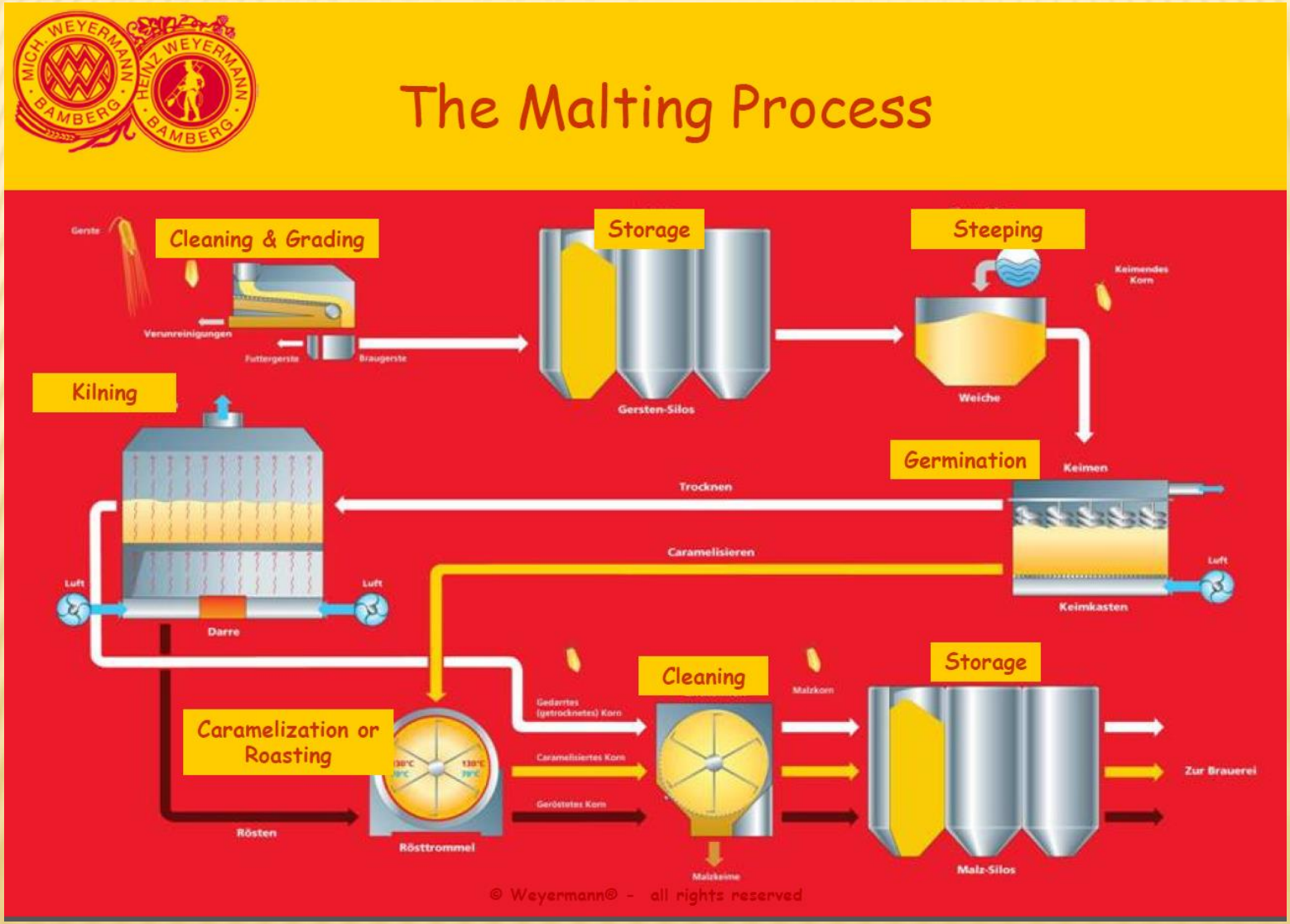
EFFECTS ON MAILLARD REACTION

	Speed Up Maillard Reaction	Slow Down Maillard Reaction
Protein	More	Less
Reducing Sugar	More	Less
Temperature	Higher	Lower
Water	Less	More
Cooking Time	Longer	Shorter
pH	Higher	Lower
Pressure	Lower	Higher

MELANOIDIN FLAVORS

- The Good:
  - Malty, Bread-Crust, caramel, coffee, roasted
  - Sweet, nutty, butterscotch, toffee
  - Molasses, dark fruit, winey
- The not-so-good:
  - Bitter, burnt, onion, cabbage
  - Veggie, gouda, fermented soy beans…
- No class of compounds has been shown to be as important in foods.

MELANOIDIN MALT



A LITTLE DISCUSSION ON ENZYMES

- Proteins that act to perform a particular function.
  - Typically, acts as a catalyst for a reaction. Very specific to the atomic structure of what is going on.
  - Won't get into all details of enzymes – that's another topic!
- -ase
  - Means "To Cleave"
  - Phytase: Cuts Phytin (complex organic phosphate) and produces Phytic Acid.
  - Protease: Cuts Proteins and produces smaller proteins, amino acids, or enzymes. (general term; non-specific enzyme)
  - Amylase: Cuts Amylose and Amylopectin producing smaller sugars.
  - Maltase: Cuts Maltose producing Glucose…
  - Etc…

ENZYME "HEALTH"

Category	Enzyme	Breaks down	Produces	pH	Temperature	Denatures
Acid	Malt Phytase	Phytin	Phytic Acid	4.4 - 5.5	86F - 126F	~ 140F
Protein	Beta Glucanase	Beta Glucan	Smaller Protein	4.5 - 5.0	98F - 113F	~ 140F
	Peptidase	Proteins	Amino Acids	4.6 - 5.2	115F - 135F	~ 145F
	Protease	Proteins	Smaller Proteins (head retention / haze)	4.6 - 5.2	115F - 135F	~ 155F
Sugar	Maltase	Maltose	Glucose	6.0	95F - 104F	~ 130F
	Beta Amylase	Amylose	Maltose; small sugars	5.0 - 5.6	130F - 150F	~ 160F
	Alpha Amylase	Amylose	Dextrins; large sugars	5.3 - 5.8	155F - 167F	~ 170F

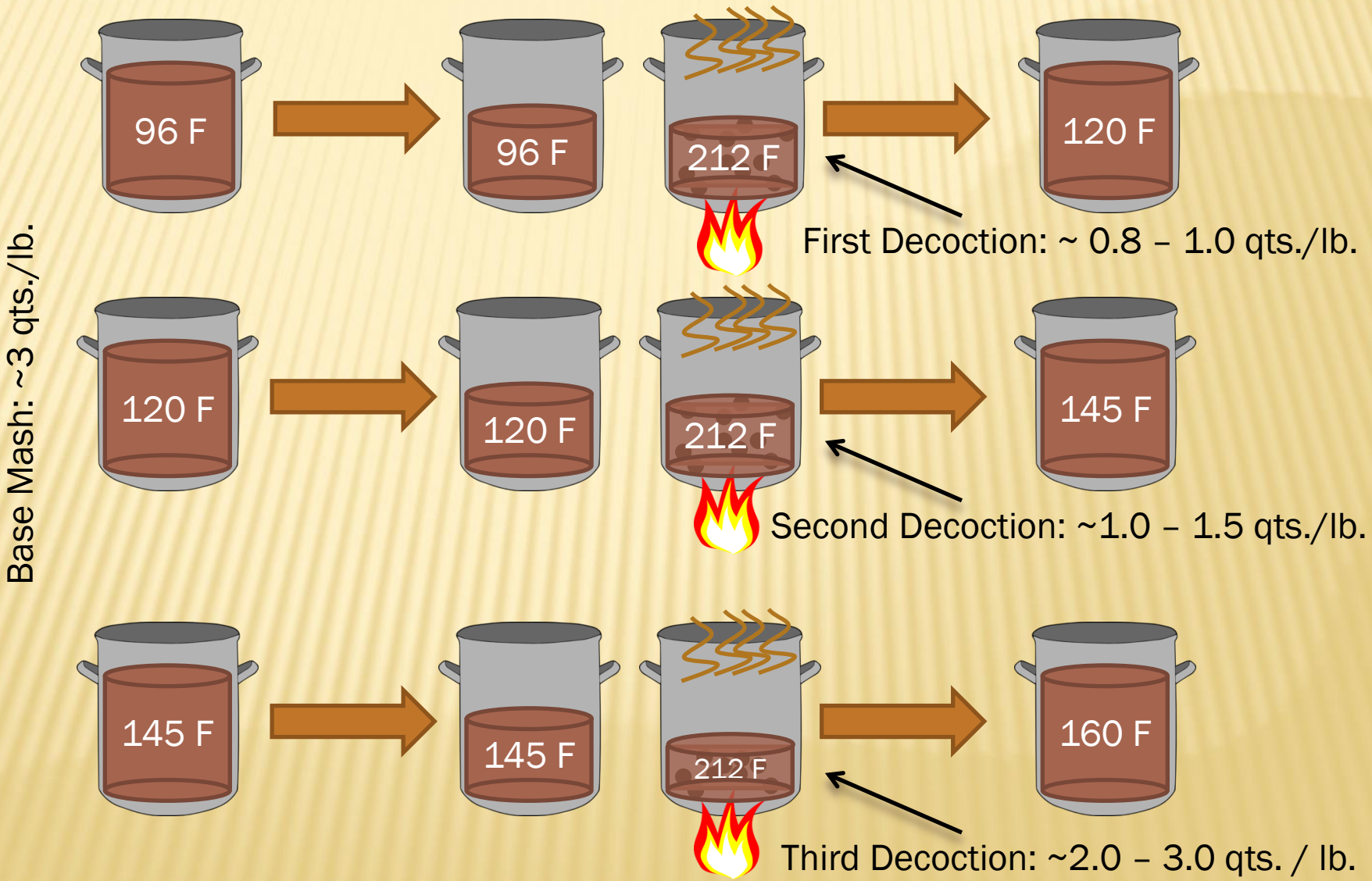
ACID RESTS

- Acid rests were traditionally used to lower mash pH.
- Most of this function can now be accomplished through a detailed knowledge of water chemistry.
- Acid rests are still used by some German brewers mainly due to limitations on the use of water additions (cannot add acid or salts)
- Works in two ways:
  - Malt Phytase breaks down Phytin to produce Phytic Acid.
  - Lactic Acid produced by Bacteria growing on the malt corn itself.

MASH THICKNESS

- Decoction brewing traditionally uses a thinner main mash; typically around 2-3 qt./lb.
  - This will result a somewhat higher pH. Acid rest may compensate some.
- However, the mash thickness of the decoction pulls themselves traditionally tend toward a thicker mash; closer to 1 qt./lb.
  - This is far from gospel. Many variations occur.
  - A thinner decoction will help reduce chances of scorching.
  - A thicker decoction will produce more melanoidin.

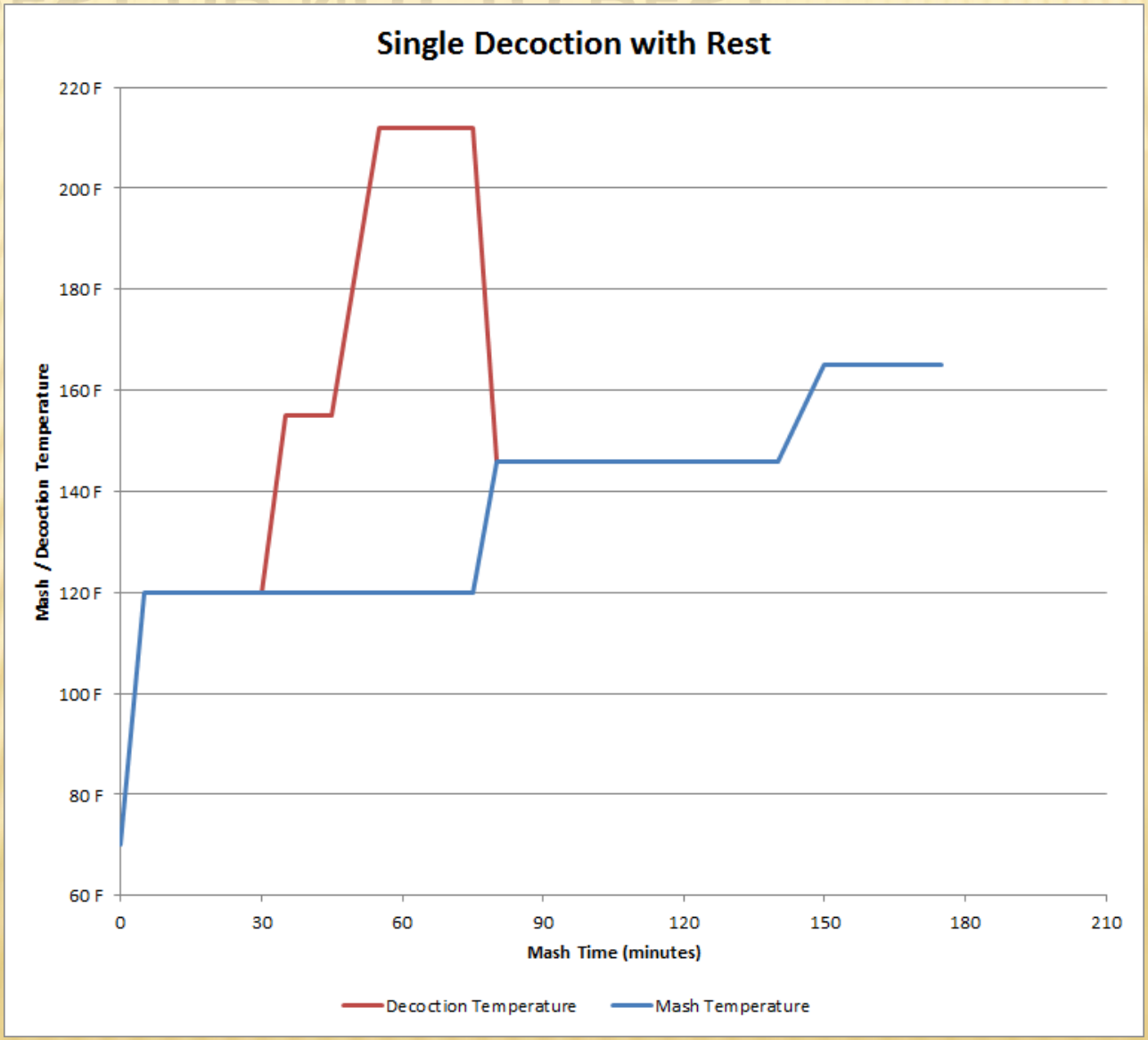
MASH THICKNESS



DETERMINING THE VOLUME TO DECOCT

- Basic Formula
  - F = (TS – TI) / (TB – TI – X)
    - F = Fraction (% of mash to pull)
    - TS = Target step temperature
    - TI = Initial Temperature.
    - TB = Decoction temperature (typically boiling)
    - X = Equipment Factor (usually around 18F)
- Thickness impact
  - There is also a small impact from the decoction thickness. The thinner the decoction, the less volume is needed to make the temperature step.
- Software
  - Most modern brewing software will calculate this for you and some even take into consideration the thickness component.

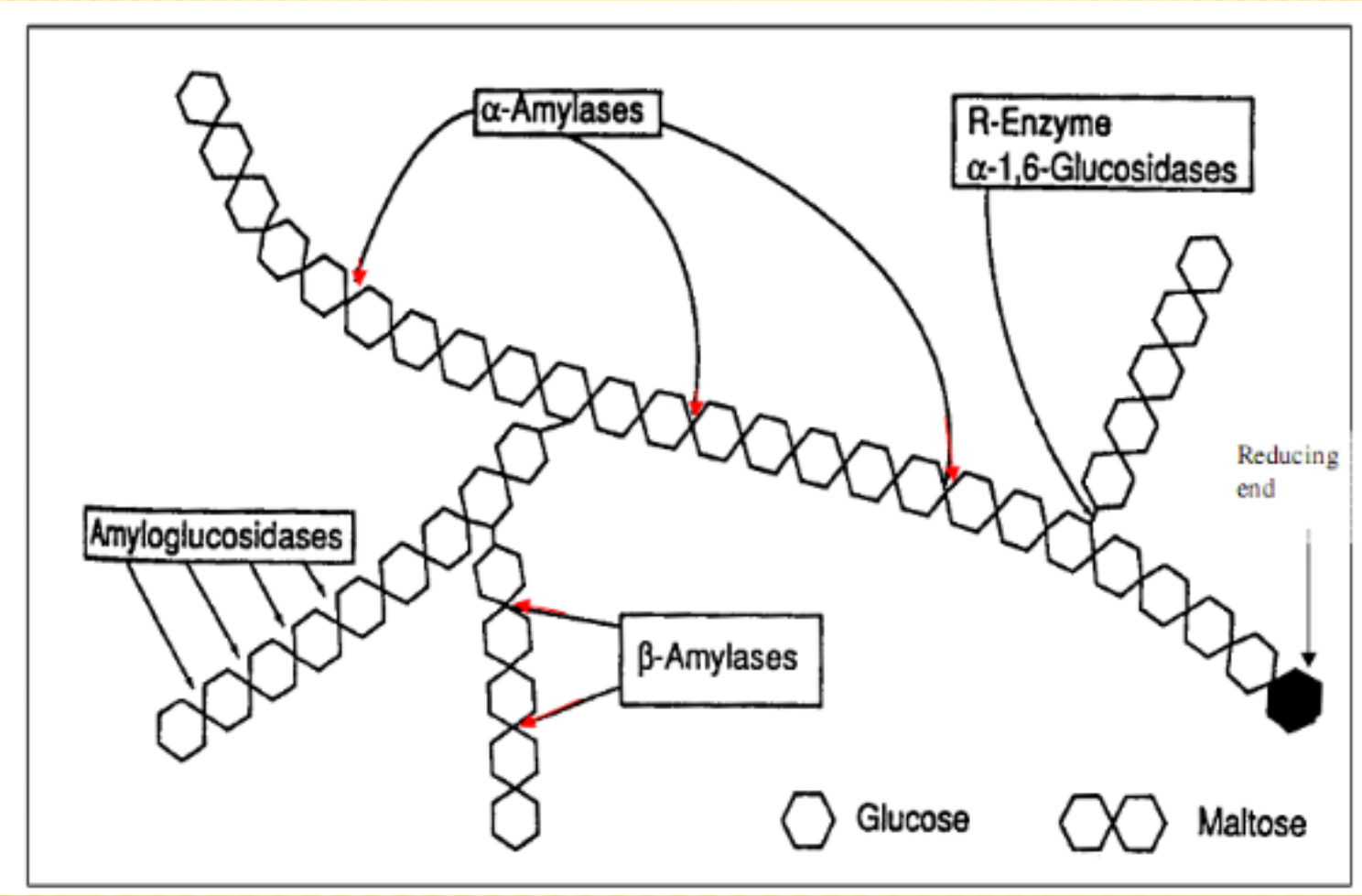
TO REST OR NOT TO REST



WHY REST?

- Performing the Alpha Amylase rest during the decoction itself can be useful for a few things:
  - It can break down more starch to dextrinous sugar which can provide for more melanoidin production during the decoction boil.
  - It can create more sugars to become available for Beta Amylase in subsequent mash steps.
- This process is particularly good for light, thinner body beers like Continental Pilsners. May cause later over-attenuation in some styles.

EFFECT OF RESTING



IMPACT ON EFFICIENCY

- More starch exposed due to grain cell walls being destroyed during boil and better gelatinization of the starch.
- More “borderline” malt converted.
- Almost always have some amount of higher temp conversion even if you don’t rest.
- If using adjuncts, can help with gelatinization of these as well.

TANNIN EXTRACTION

- Boiling the mash DOES extract more tannins than a traditional infusion mash will.
- However, decocted beers are not known for being highly astringent in an unpleasant way.
- There are several schools of thought on this:
  - Boiling with large amounts of sugar will help buffer the polyphenol production during decoction
  - Enzymatic processes in the mash after reintroducing the decoction help to break down the tannins.
- While all the mechanisms here aren't completely clear to me, this advice is:
  - IF you use decoction to achieve mash-out, ONLY pull liquid; not grain.

SOUNDS LIKE A LOT OF WORK!

PFLEV

- Personal Flavor Labor Enhancement Value…
- The more effort you put in the beer, the better it tastes… at least to you…

EQUIPMENT CONSIDERATIONS

Mash Tun

Measuring Device

Decoction Pot

Burner

Thermometer (optional)

USING BREW POT AND BURNER

- Use of smaller volume decoction pot may be easier, esp. in terms of moving the decoction back into the main mash.
- Certainly possible to use your final brew pot.
- Just clean it between decoction and boil → residual husk material can lead to astringency later.

CAN ENABLE INTERESTING MASH PROFILES

- Alpha Amylase before Beta Amylase
- Beta Amylase Decoction followed by Maltase main step (creates Glucose).

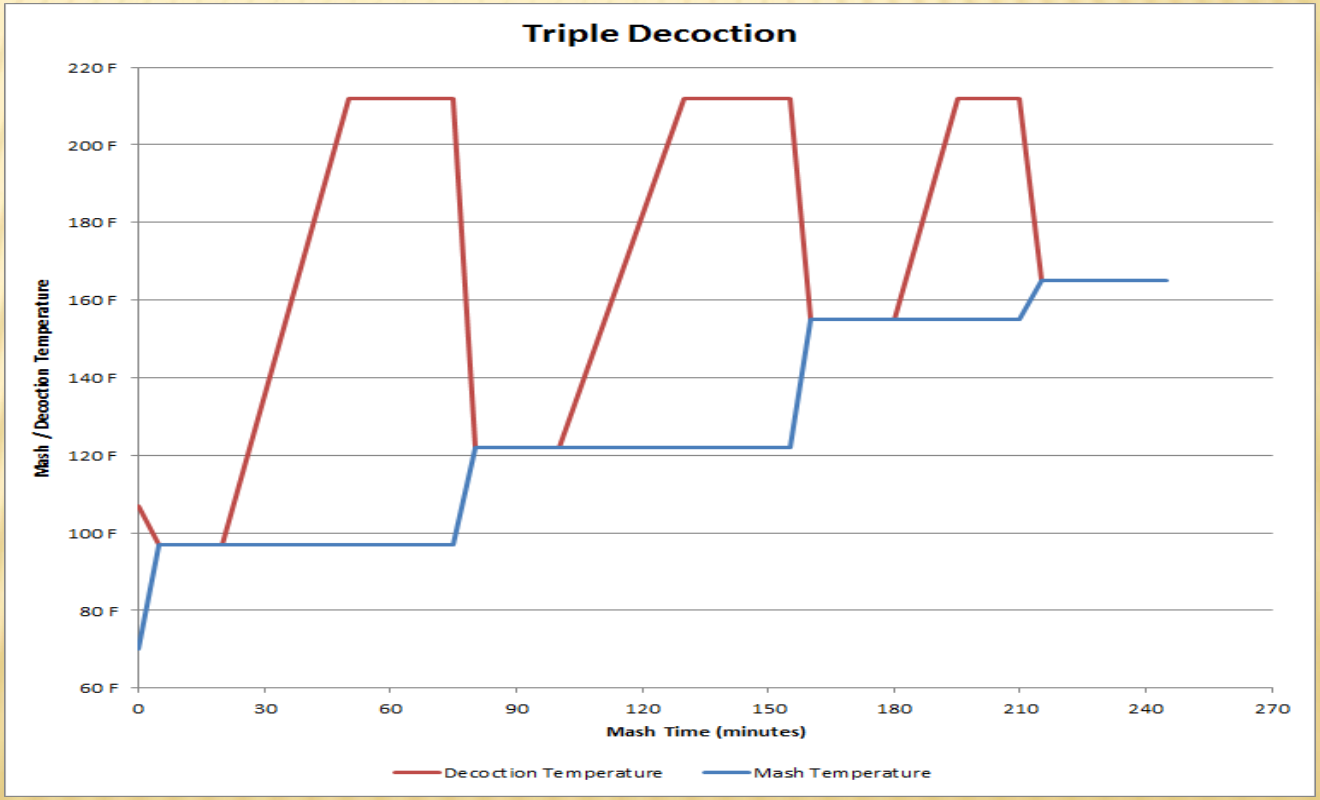
TIPS TO MAKE YOUR DECOCTION EASIER

TIP #1: HAVE A PLAN

- Where am I going to heat the decoction?
- How am I going to measure volumes / temperatures?
- How do I prevent making a mess?
- How do I calculate how much I need?
  - And changing conditions
- How long is it going to take?
  - Add buffer time
- Can I do other things in parallel?
  - Like, Drink a beer?

TIP #2: THINGS TAKE LONGER THAN PLANNED

- It's easy to make a graph that shows ramping up to boiling in a few minutes…



TIP #3: DON'T SCORCH IT!

- Although you might want to combat Tip #2, burnt is not generally what we're going for here…

TIP #4: WATCH SPLASHING

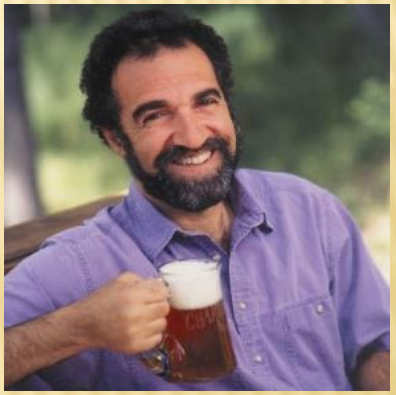
- Hot Side Aeration can be introduced.
- Particularly in some more subtle lager beers; something to avoid.

TIP #5 CONSIDER OTHER IMPLICATIONS

- Extra protein generated – do I need rice hulls?
  - RIMS Process in particular (the dopplebock being passed around really jammed up my system)…
- Impact on efficiency
- Volume capability of pot / mash tun
- Impact on Sparge Water needed

TIP #6: RDWHAHB

- Okay, certainly, not my original tip, but good advice.
- In fact, each decoction step is an excellent time to do just that.
- Don’t sweat every temperature step.
- Remember, this was originally done before thermometers even existed!



Told you I'd come back to this…

YOU NEVER NEED TO DO A DECOCTION!

TRUE – YOU DON'T NEED TO DO THIS.

- Modern malt choices and consistency
- Other adjuncts available
- Time and Effort…

DO YOU REALLY NEED TO MAKE BEER?

- Huge variety of high quality craft beer out there.
- Generally can find a good particular beer style faster than I could make one.
- Not really cheaper to brew my own
  - Ingredients
  - Propane / Gas
  - Chemicals
  - Capital Investments
  - Time

I CAN JUST USE SPECIALTY MALTS

- Yes, you can, and you should really try to understand what flavors different malts can contribute.
- Some will be very similar.
- But the reactions involved in making melanoidin in malt are just not the same as in a decoction.
- Some will argue they taste close enough. Some will argue otherwise.
- It's up to you to decide for yourself.

SO, WHY DO WE BREW?

- PFLEV
- Process
- History
- Love of the craft.

DECOCTION IS MUCH THE SAME WAY

- PFLEV
- Process
- History
- Options you can’t do with normal mashing

MOST BREWERIES DON'T DECOCT

- Unlike homebrewers, it takes some significant equipment addition to be able to decoct.
- And longer process time means higher cost and lower throughput.
- However, it is nice to start seeing some decoction capable breweries start up recently…
  - Devil's Backbone Brewpub - Virginia
  - Adelbert's Brewery – Texas
  - Many more…

Who entered the triple decoction Imperial IPA?

WHAT BEERS SHOULD I DECOCT?

GENERALLY, MALTY BEERS ARE THE WAY TO GO

- Traditional European Lagers:
  - Marzen, Vienna Lager, Bocks
- Continental Pilsners:
  - In particular, Bohemian Pils does well with decoctions.
- German Wheat Beers:
  - “Special” decoction to bring out the banana

OTHER BEERS THAT DECOCT WELL

- Big Beers:
  - Barleywines, Old Ales, Strong Scotch Ale
- Some Hybrids:
  - Altbier, Kolsch

I WOULDN'T BOTHER WITH…

- Very hoppy beers:
  - APA, IPA, etc.
- Beers with caramel as dominant flavor:
  - English Ales
  - Some Brown Ales
- Beers with other distinctive characteristics:
  - Steam Beer (Cali Common)
- Strong Roasted Malt Beers
  - Porters, Stouts
  - Schwartzbier

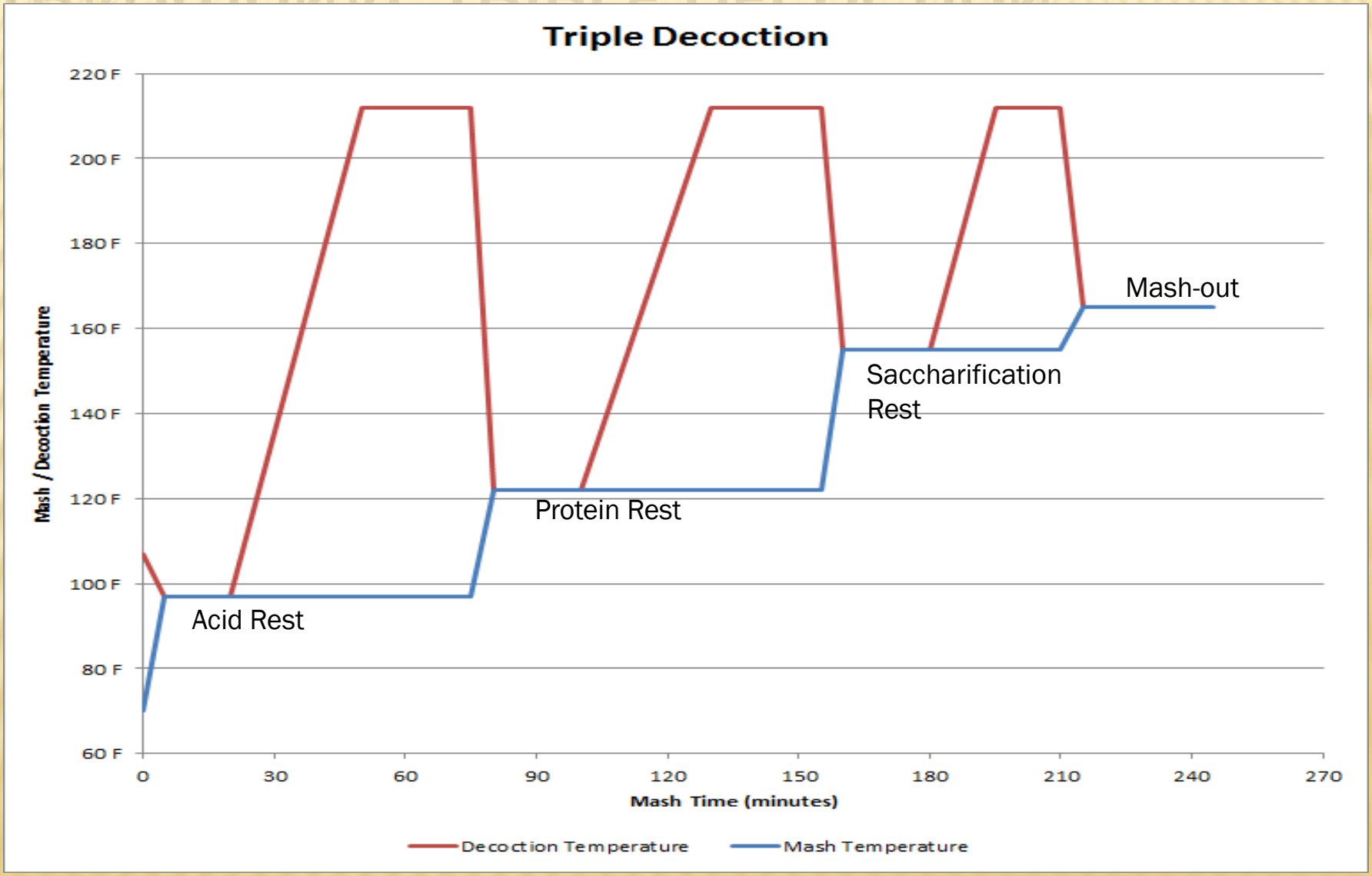
STYLES WORTH EXPERIMENTING WITH

- Belgians
  - Esp. Belgian strong ales
- Scottish / Irish
- Hey, you're the brewer – decide for yourself!

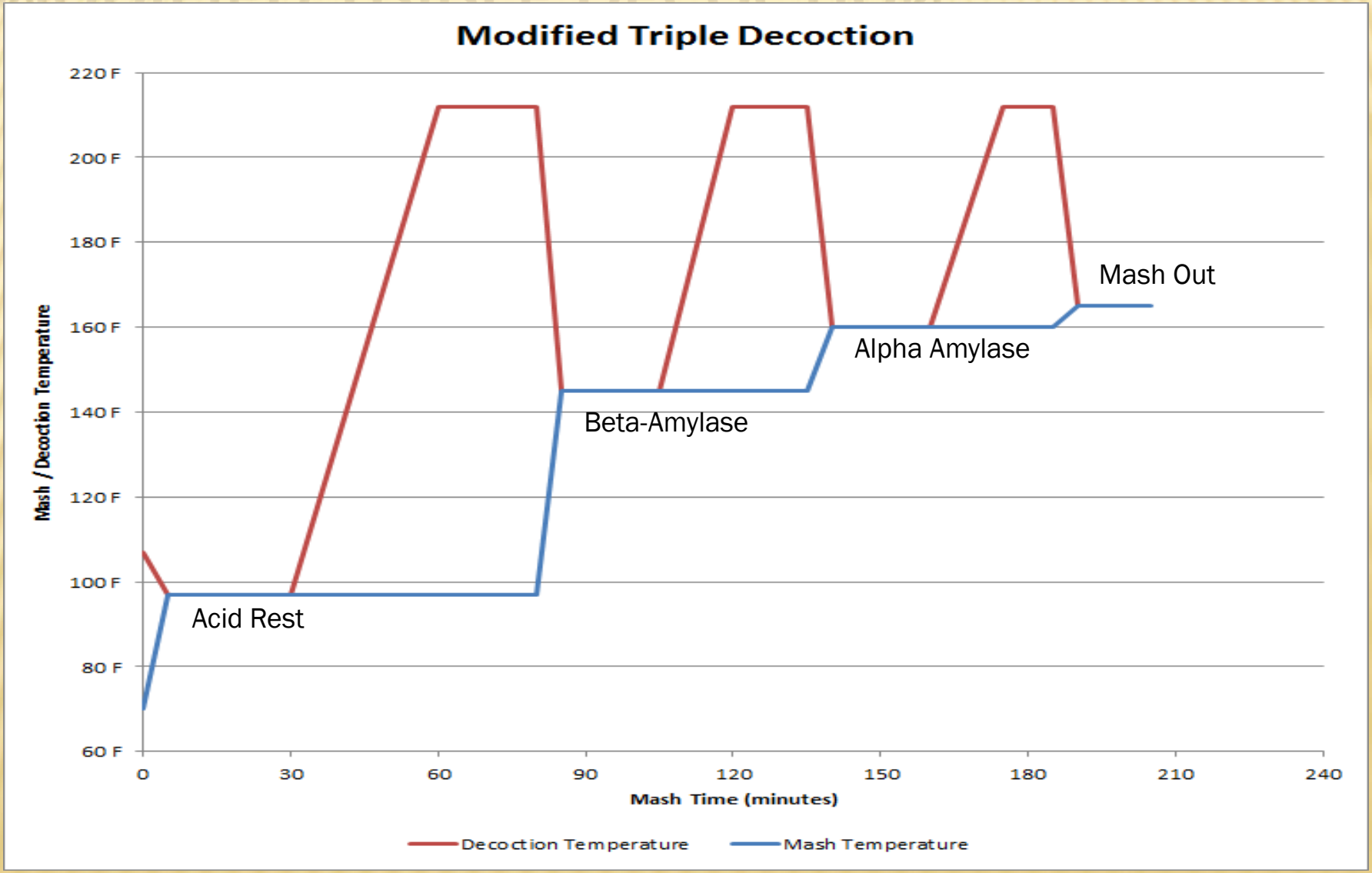
Drink if you like graphs

DECOCTION SCHEDULES

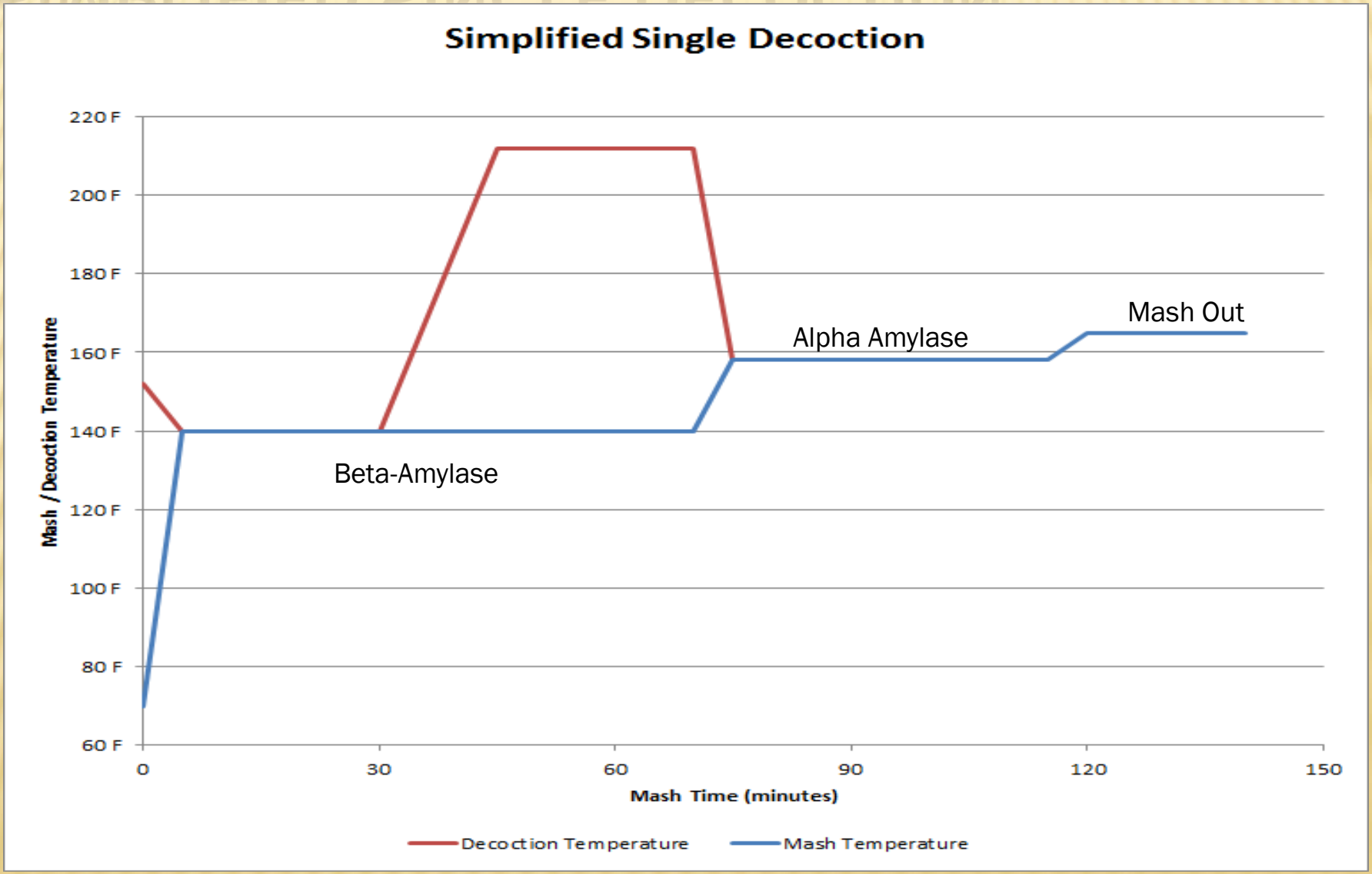
TRADITIONAL TRIPLE DECOCTION



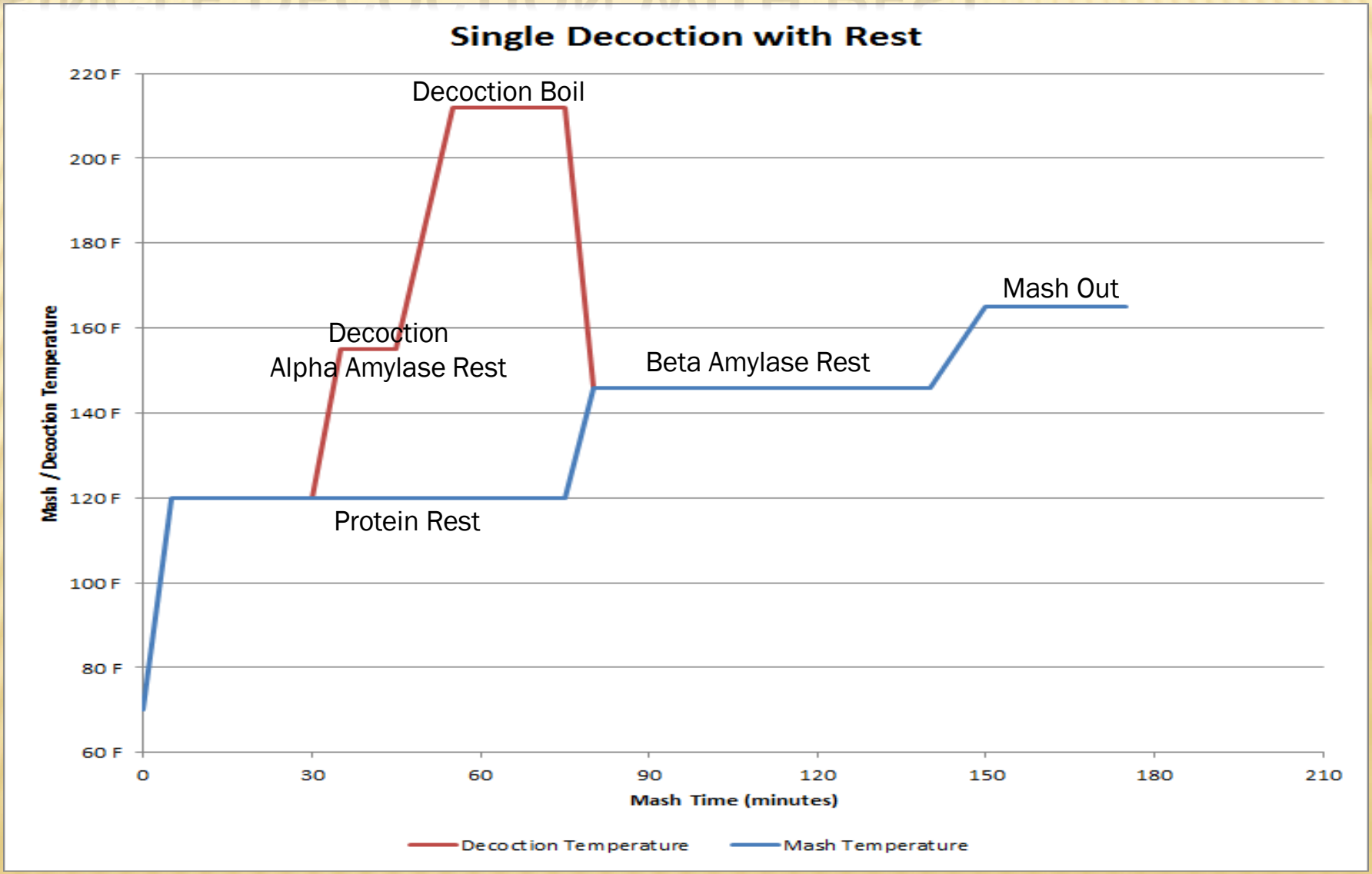
MODIFIED TRIPLE DECOCTION



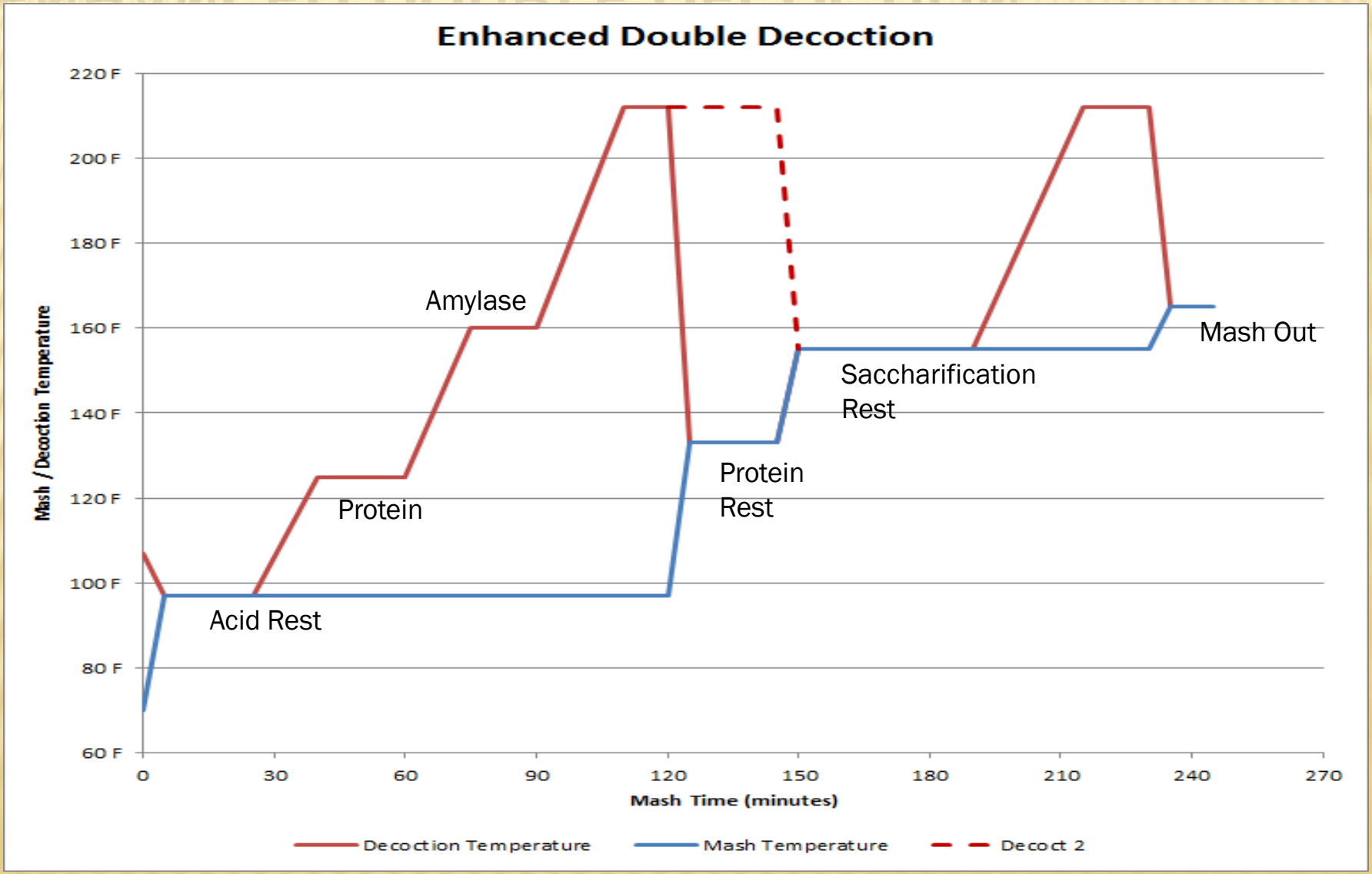
SIMPLIFIED SINGLE DECOCTION



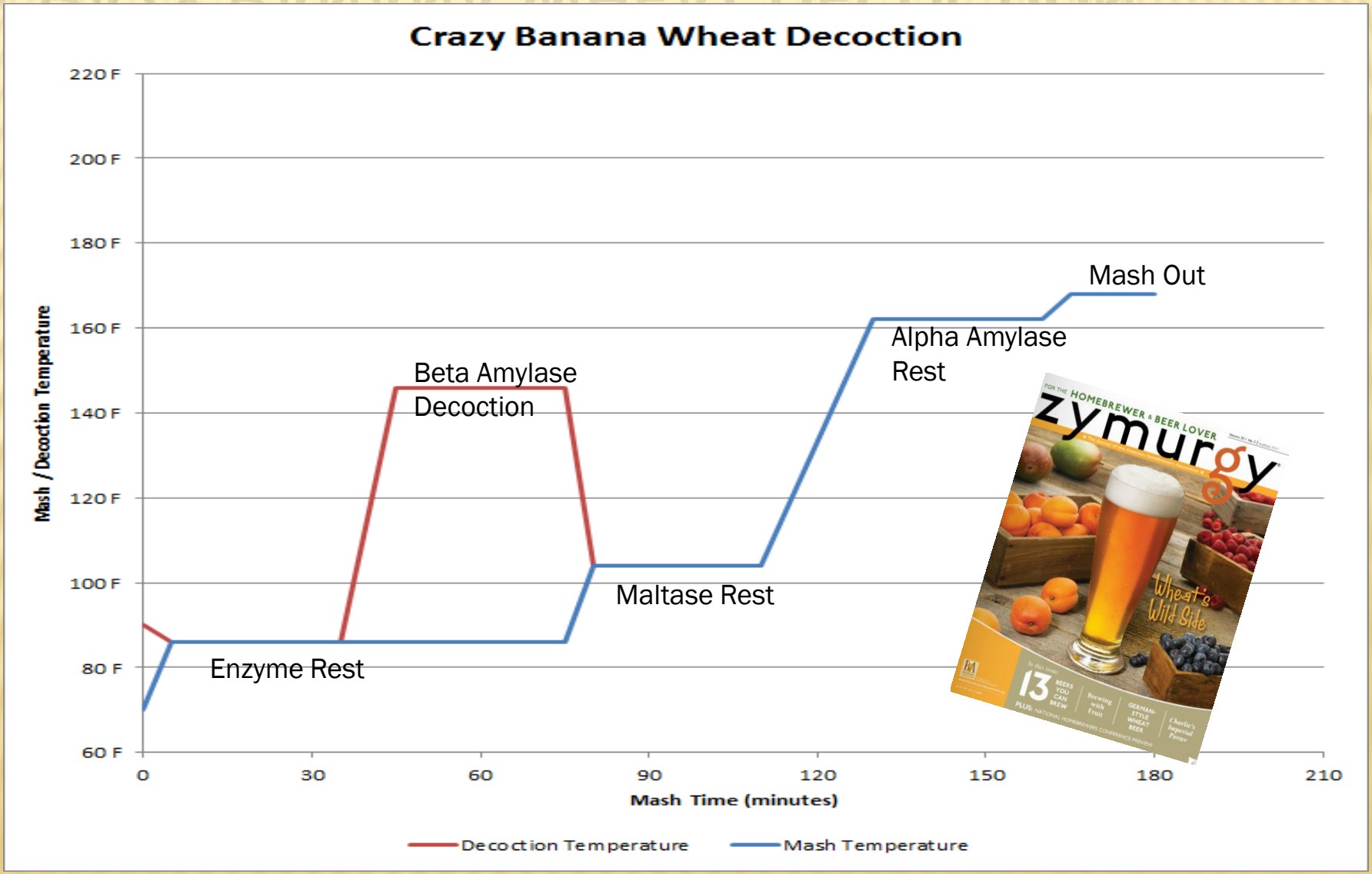
SINGLE DECOCTION WITH REST



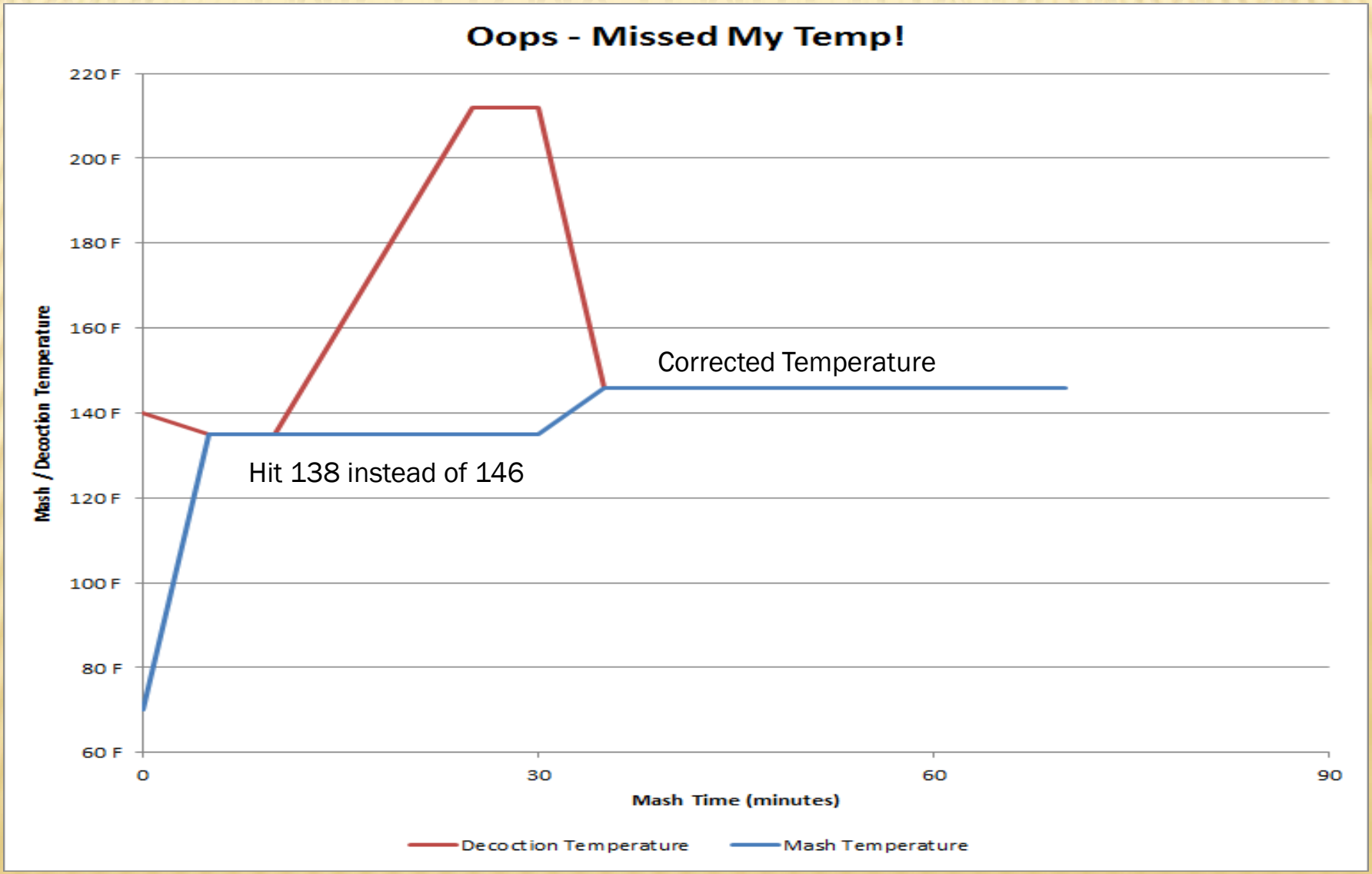
ENHANCED DOUBLE DECOCTION



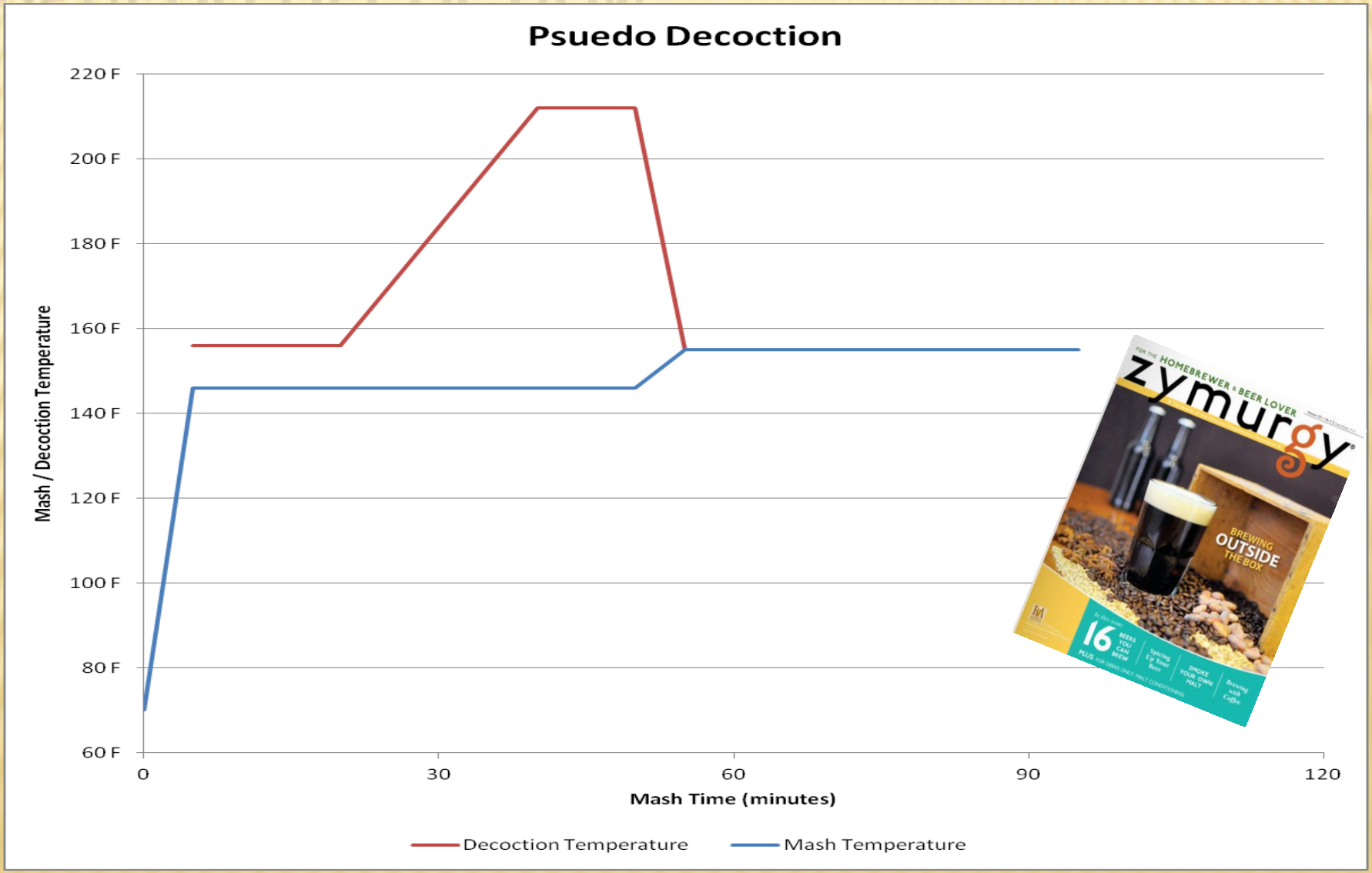
CRAZY BANANA WHEAT DECOCTION



“OOPS – I MISSED MY TEMP STEP” DECOCTION



PSUEDO-DECOCTION



MANY OTHER VARIATIONS EXIST

- Classic Double Decoction
- Hochkurz Double Decoction
- Quadrouple Decoction
- Invent your own!

WRAP - UP

YOU NEVER NEED TO DO A DECOCTION.

- Maybe, but like any other brewing process, this can be a valuable tool to have available.
- Try it – you might find it's not so bad. Might even be fun!
- And the knowledge you learn along the way may help with non-decocted beer too…

SPECIAL THANKS

- Devil's Backbone Brewing Company
- Weyermann Malt

QUESTIONS?