

HOMEBREW CON 2020

Saturday, June 20

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<https://bsghandcraft.com/weyermann-malts>



Mashing techniques

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Hallmark of lager is pure, distinct malt flavor

Use the best malt you can get

Decoct your mashes

Use simple recipes of nearly only base malts-many malts results in muddled malt profile

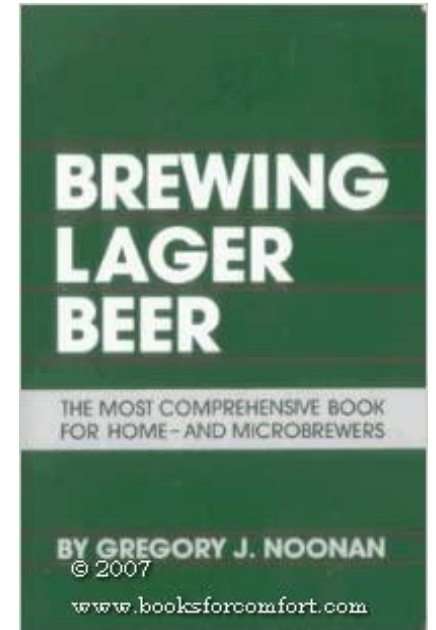


Why decoct?

Better starch conversion

- burst starch granules from boiling
- gelatinize starch
- get amylase enzymes in right order*

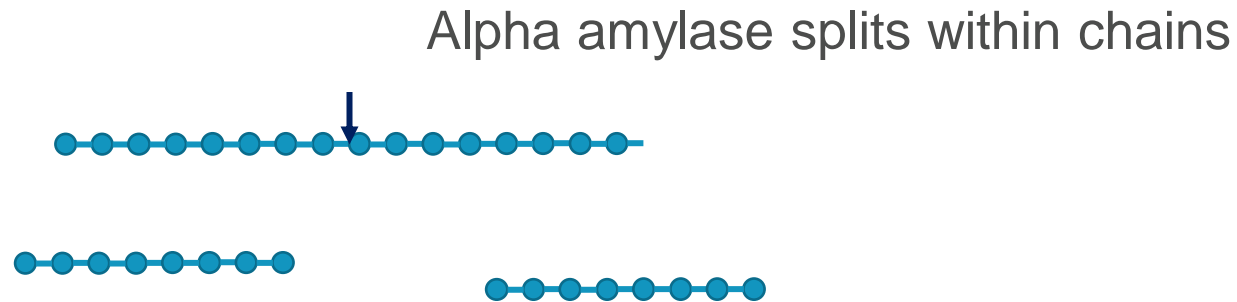
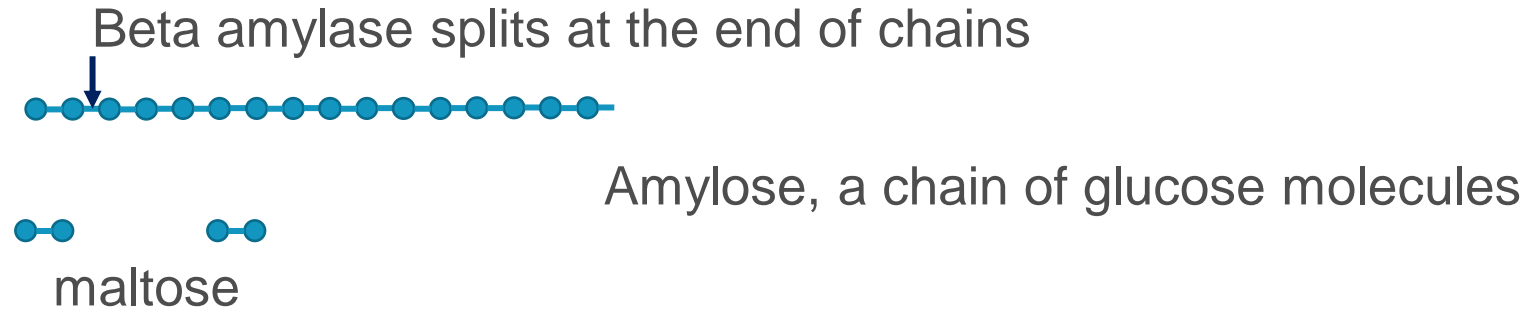
Maillard reactions: reactions between amino acids and sugars that provide the breadcrust flavor in beers. Complicated chemistry best for another day. But a real benefit for decoction.



*"Mother Nature got it backwards" Bill Eye.

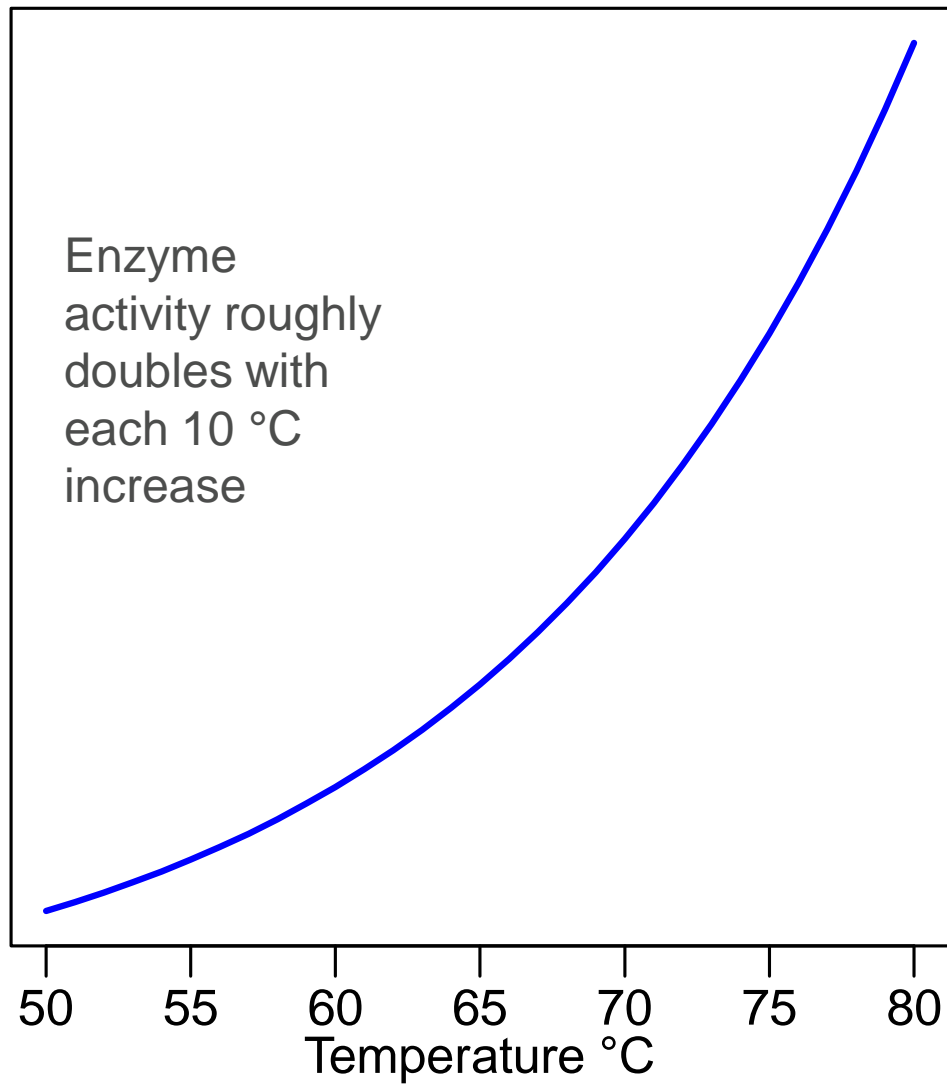


Some theory about amylase enzymes

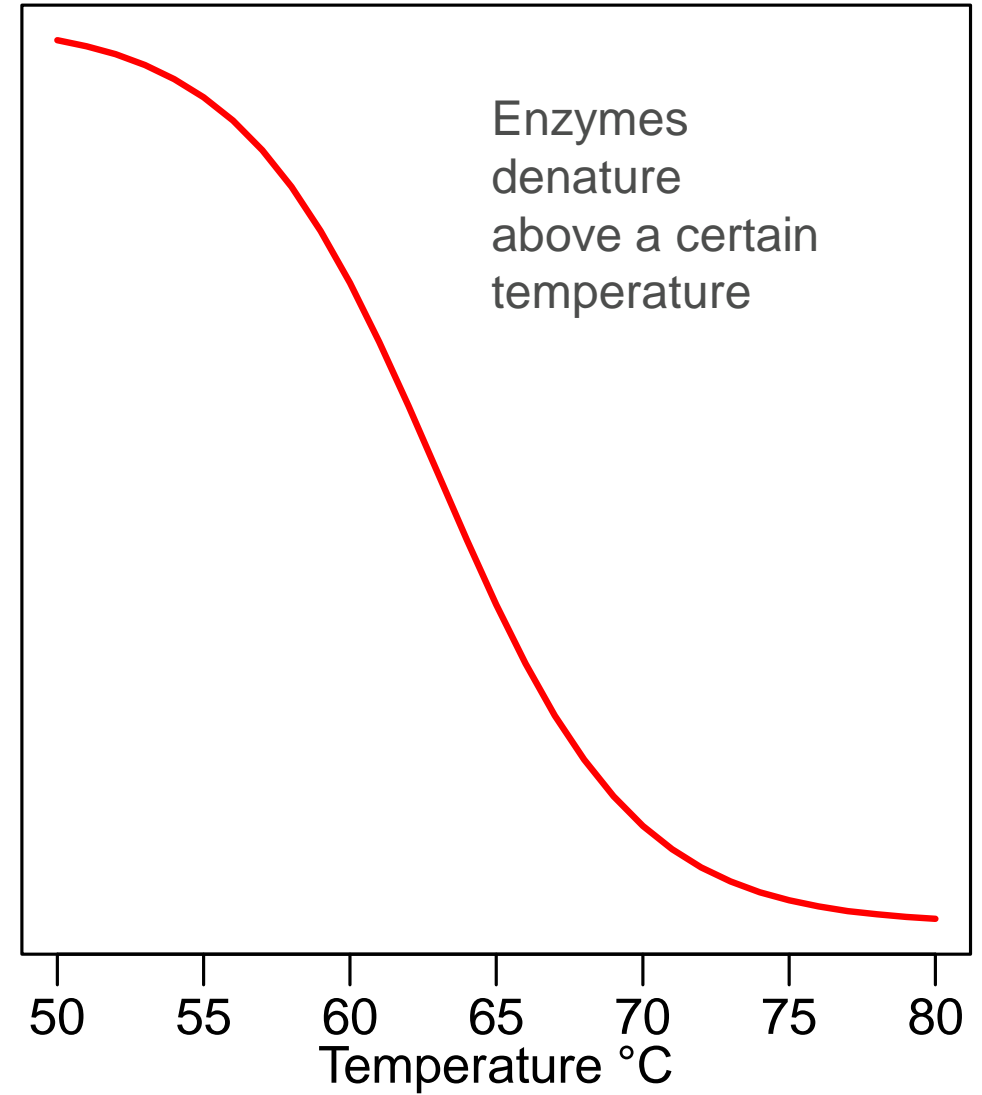


In a perfect world, Alpha amylase would convert starch to small chunks of polysaccharides so Beta could chop off 2-unit maltose

Enzyme activity

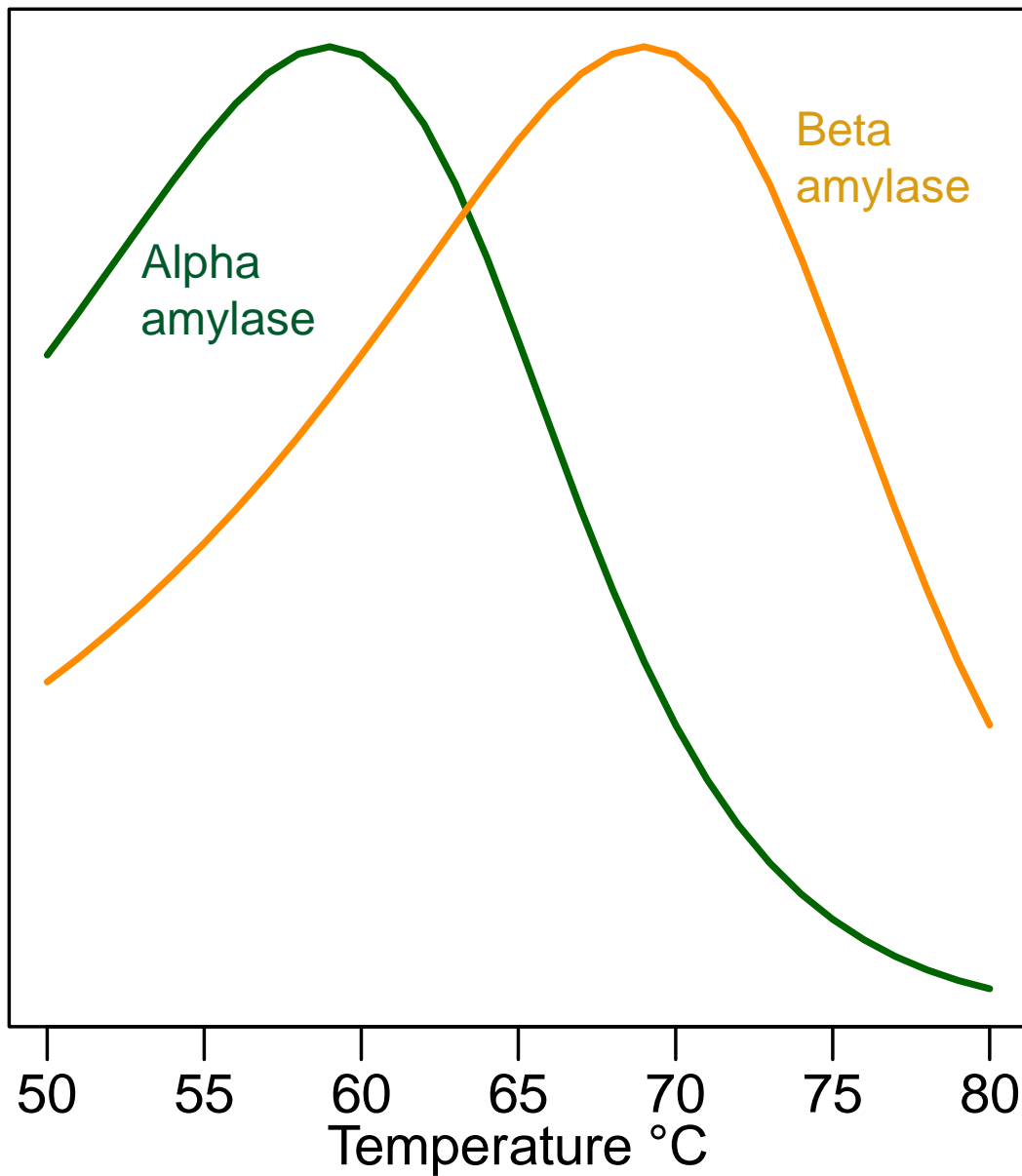


Enzyme decay



Assumes a logistic model for enzyme decay

Enzyme activity at set time



Combine the previous curves

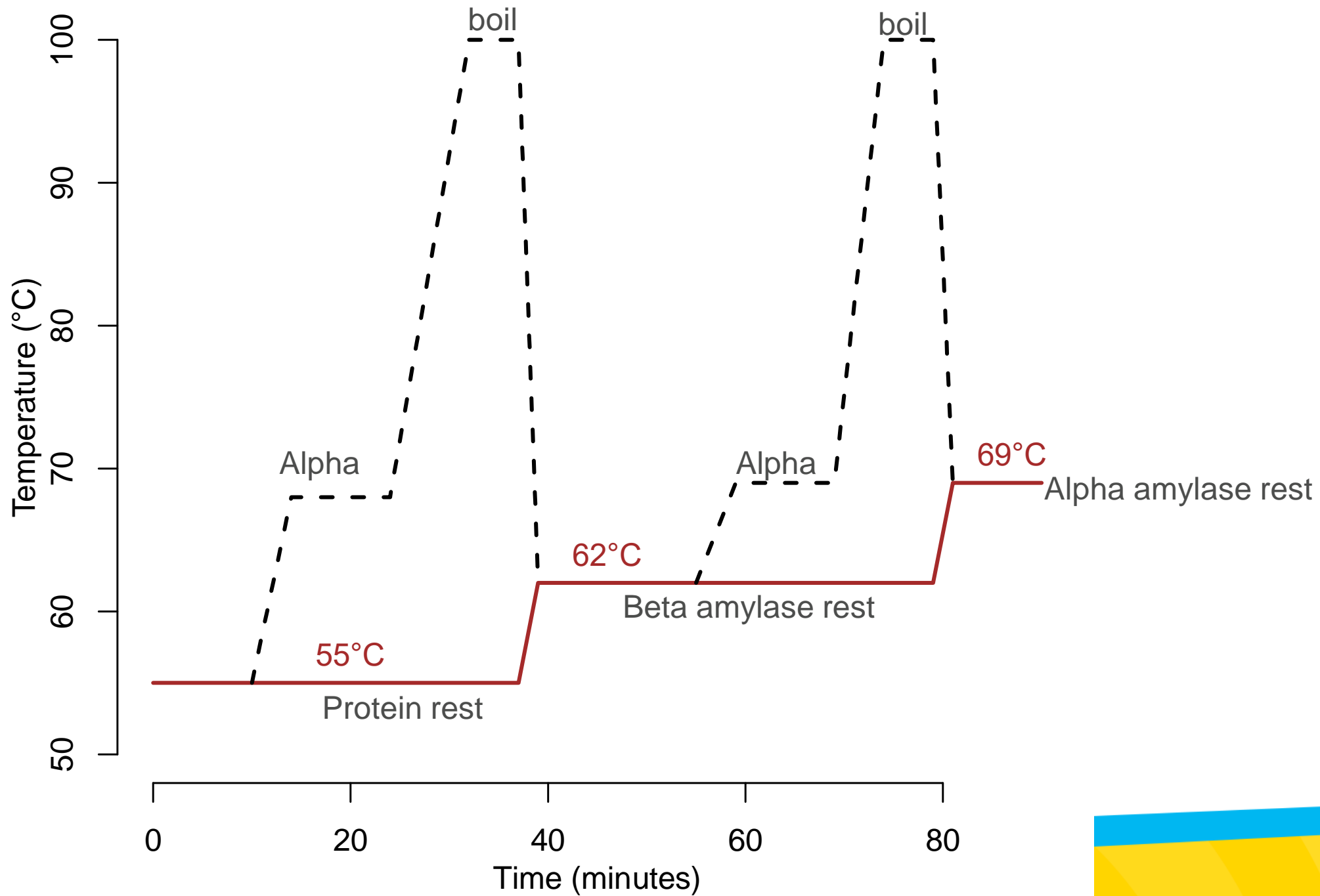
Decoction allows us to get the enzymes activities in the correct order with alpha before beta!

Caution: These curves are heuristic and not based on actual data! They will change with temperature and pH

Decoction schedules. (There are many)

Present double decoction schedule along the lines of the *hochkurz* mash schedule. Short and hot.

Modern malts are modified enough that the extensive long schedules of yore are no needed.



Protein rest



First decoction



A pictorial decoction schedule

(first ever brew kettle from 1990)



alpha rest



boil



**Return to
main mash**



Beta rest



Pull second decoction



boil



Return



**alpha rest
main mash**



Why NOT decoct? I have no reason....

Time, takes too long. My schedule is 100 min and adds adds 40 min to brew day. Have another beer. Short schedule is better than no decoction. Highly modified malts do not require the long schedule in Noonan.

Difficult. **Nope**. You cant screw it up, mash goes through alpha rest 3 times, it's going convert whether you want to or not

Equipment. Kitchen stove and your first extract brewing pot. (though induction burner would be nice)

I am making English IPA. Ok, good reason to not decoct. (But I do decoct Koelsch and Altbier)



Decoction allows for simple recipes with rich, complex malt and high attenuation

“February” Munich Dunkel

23 L (6 gal) at knock out

3.9 kg (79.4%) Weyermann Barke Munich malt

0.9 kg (18.7%) Weyermann Barke Pilsner malt

90 g (1.9%) Black Pearl roasted barley (340L). Cold extracted.

2.0 g alpha acid* low alpha hop boil 60 min

0.5 g alpha acid same hop, boil 10 min

Wyeast 2124 (see Ashleigh’s talk for pitching rate)

Low alkalinity water

Double decoction schedule as above. Boil O.G. 1.053. Ferment at 9°C for 14 d, lower at 1°C/day to 4°C, hold 10 more days.

Rack to keg, lager >1 month. FG 1.011

* equals e.g., 50 g of 4.0 % alpha acid hops



Simplest Pilsner: “March”

23 L (6 gal) at knock out

4.5 kg Weyermann Barke Pilsner malt

120 g Weyermann acidulated malt

5.7 g alpha acid hops added at first wort (I used 100 g Liberty*, 5.7% AA.)

Wyeast 2124 yeast

Low alkalinity water

Double decoction schedule as above. O.G. 1.051. Ferment at 9°C for 14 d, lower at 1°C/day to 4 1°C, hold 10 more days. Rack to keg, lager 1 month. FG 1.009

*I will use another hop next time, citrus notes too high. Yes this makes a bitter Pilsner!



...which brings us to Jesse Brown
on using hops in lagers.



A BRIEF HISTORY OF NOBLE HOPS

In the 1980's Americans coined the term
NOBLE HOPS

This group of European hops were originally

- Saaz
- Tettnanger
- Spalter
- Mittelfruh

Noble hops have notes of

- Citrus
- Herbal
- Floral
- Spruce
- Spice

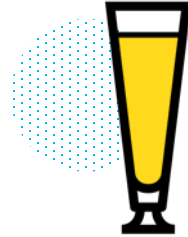
Noble hops also have a **LOWER ALPHA ACID** content and, at times, **HIGHER BETA ACID.**

FAST FORWARD TO THE RISE OF AMERICAN LAGER HOPING



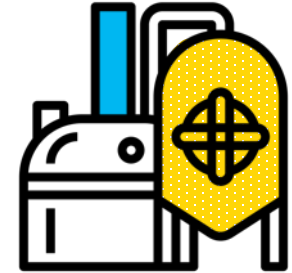
THE BIG DRIFT

Seeking new flavor and aroma, American brewers drift towards American high alpha hops. These sneak into classical continental lager styles.



THE RISE OF DRY-HOPPED

Dry-hopped Pilsner, or Italian Pilsner, begins in the 2010's. The best-known American example is Pivo Pilsner by Firestone Walker Brewing Co.



THE BURGEONING STYLE

Birrificio Italiano - Tipopils
Green Cheek - Local Import
Oxbow Brewing - Luppolo
Firestone Walker - Pivo Pils
Wayfinder Beer - Terrifica Pils
Lowercase Brewing – Italian Pilsner



CONTEMPORARY AMERICAN STYLE PILSNER

MALTS	Pounds	Percentage
Weyermann Pils	6.4	77.2
Flaked Rice	1.7	20.5
Weyermann Acid	3oz	1.7

WEIHENSTEPHAN LAGER YEAST 3470

Mash in: 148F or 64.5C Water:SOFT 90 min boil

OG 12.2 – FG 2.4

They use corn or rice to lighten the body and let the punched-up hops shine.

5-gallon batch


HOPS	AMOUNT	TIME
Magnum	.25oz	60
Saphir	1oz	30
Saphir	1oz	15
Citra	3oz	WP
Loral	3oz	WP
Pacifica	3oz	WP



A BITTER PLACE TO START

HIGH ALPHA CULTIVARS HOP RESEARCH CENTER HULL

- 1 Bitter in the kettle with High alpha hops.
- 2 Magnum, Polaris, Herkules or even Tradition.
- 3 Look for high alphas that have characteristics with Noble profiles

	Yield kg/ha	Quality			Resistance towards				
		Aroma Scores (max. 30)	α -Acids (%)	Cohumu- lone (%)	Vert. Wilt (mild)	Downy Mildew	Powdery Mildew	Spider Mite	Hop Aphid
Northern Brewer	1,600	22	8 - 10	27 - 32	+++	-	--	-	--
Hallertauer Magnum	2,000	22	11 - 16	21 - 29	++	+	---	-	---
Hallertauer Taurus	2,000	22	14 - 19	20 - 25	+	-	---	--	-
Polaris	2,100	22	18 - 23	17 - 22	+(+)	+/-	+/-	-	-
Herkules	2,700	22	14 - 19	32 - 38	+(+)	+/-	+/-	-	-


Resistance: +++ very good; ++ very good to good; + good; +/- medium;
--- very poor; -- very poor to poor; - poor
Aroma Scores: 22 = pleasant aroma

A NOBLE FINISH

Flavor impacts of the following varieties:

- 1 Saaz – lemons, fresh cut grass, herbal
- 2 Tettnanger – herbal, lemons
- 3 Hallertauer – Lime, floral, herbal
- 4 Spalter – Floral , spicy, sometimes lime

TRADITIONAL FINE AROMA CULTIVARS HOP RESEARCH CENTER HULL

	Yield kg/ha	Quality			Resistance towards				
		Aroma Scores (max. 30)	α -Acids (%)	Cohumulone (%)	Vert. Wilt (mild)	Downy Mildew	Powdery Mildew	Spider Mite	Hop Aphid
Hallertauer Mittelfrüh	1,250	26	3 - 5	18 - 28	---	---	+	-	-
Hallertauer Tradition	2,000	26	4 - 7	24 - 30	+	++	+	-	+
Spalter Select	2,000	26	3 - 6	21 - 27	++	++	-	+/-	++
Perle	2,000	24	4 - 9	29 - 35	++	++	-	-	-
Saphir	2,000	27	3 - 5	12 - 17	+	-	+	+/-	+/-
Smaragd	2,000	26	4 - 6	13 - 18	+	++	-	+/-	+/-
Opal	2,000	26	5 - 8	13 - 17	+	++	+	+/-	+/-

Resistance: +++ very good; ++ very good to good; + good; +/- medium;
 --- very poor; -- very poor to poor; - poor
 Aroma Scores: 26-27 = fine to noble aroma quality; 21-23 = pleasant aroma

OLD WORLD **NEW** FLAVORS

MID TO HIGH ALPHA

HOPS		GROWING REGION
AKOYA	AA% 9-10 BETA % 4-5	GERMANY
SOLERO	AA% 9-10 BETA% 5-6	GERMANY
ARIANA	AA% 9-10 BETA % 4-5	GERMANY
HALLERTUA BLANC	AA% 9-12 BETA% 4-6	GERMANY
STYRIAN DRAGON	AA% 6-11 BETA% 7.5-8.5	SLOVENIA
STYRIAN WOLF	AA% 11-18 BETA% 5-6	SLOVENIA

LOW ALPHA

HOPS		GROWING REGION
CALLISTA	AA% 4-6 BETA % 4-5	GERMANY
TRADITION	AA% 4-7 BETA% 3-6	GERMANY
SAPHIR	AA% 3-6 BETA % 4-5	GERMANY
STYRIAN KOLIBRI	AA% 2-6 BETA%1.5-5	SLOVENIA
BARBE ROUGE	AA% 3.5-6.5 BETA% 3-5	FRANCE



LEAVE YOUR ALPHA AT THE DOOR

Getting 10-30 IBU can help **NOBLE NOTES** shine thru a finished beer

Cohumulone, found in high alpha hops, can cause **COURSE BITTERNESS**

LAYER your bittering hops with Noble varieties to attain the classic citrus, floral, herbal characteristics

MY WHIRLPOOL RAN AWAY WITH THE DRY HOP

& JOHN MARTI

1

MASHING

Mash and Lauter/Sparge PH must be kept in check with acids. Creating a softer, less astringent Pilsner. John uses phosphoric and Lactic acid.

2

ADDING DRY HOPS

Dry hop addition amounts and timing is key. Using two separate dry hops, John hits the first one early in fermentation - 2lbs in a 15bbl batch, then around day 7-9 (depending on fermentation schedule) another 6 lbs. after harvesting yeast.

3

FERMENTATION

John's fermentations for this style run warmer than the traditional ones he brews. He likes 52-degrees with a 57-degree d-rest at the end of fermentation. He uses Weihenstephan Lager yeast or 3470.

4

HOPS TO USE

John has experimented with many varieties, but like the interplay of Magnum to bitter then Saphir, Santiam and Mittelfruh in the w-p; then again with Mittelfruh and Saphir in the dry hop. He calculates it at 30 to 40 ibus in his recipe.



LOWER CASE BREWING

ITALIAN PILSNER



MALTS	PERCENTAGE
German Pils	97
Acid Malt	2
C-45	1

HOPS	AMOUNT	TIME
Magnum	.30oz	60
Hallertau M.	.15oz	WP
Santiam	.15oz	WP
Saphir	.15oz	WP
Hallertau M.	.25oz	Day-3 DH
Saphir	.75oz	Day-9 DH

WEIHENSTEPHAN LAGER YEAST 3470

5 GALLON BATCH SIZE Mash @ 150
1.048-1.010 Acidify WP to 5.1
90-minute boil



BACK IN THE FUTURE

BITTERING HOPS **DO NOT** NEED TO BE BITTER

A MAI-BOCK
RECIPE

MALTS	PERCENTAGE	LBS
Weyermann Pils	81.4	9.5
Munich1	13.6	1.6
Acid Malt	3.4	0.4
Caramunich1	1.7	0.2

HOPS	AMOUNT	TIME
Tradition	.15oz	90
Tradition	.30oz	60
Hallertau M.	.4oz	45
Hallertau M.	.4oz	30

G5 WEIHENSTEPHAN LAGER YEAST 3470

Single Decoction schedule | 16.6 OG – 3.9 FG | Water to Grain = 3:1

Using noble lower alpha hop varieties early in the boil can achieve wonderful citrus notes while keeping a beer soft in bitterness.



**“LAGER HAS BEEN
KING FOR OVER 150
YEARS - I DON'T SEE
THAT CHANGING
ANYTIME SOON.”**



**“It’s all
about the
Fermentation!”
-BSI**

Ashleigh Carter
Head Brewer/Co-Owner
Bierstadt Lagerhaus
Denver, CO



History – Very Brief

Bottom Fermentation

- Term first used in Bavaria in 1420
 - Hard to brew during the summer because of the harmful bacteria that wreaked havoc on the beer
 - Started fermenting and storing beer in cool caves in the alps – where bacteria had a harder time forming because of cool temperatures, fermenting slower with less activity on the surface and harvested from the bottom of the vessels



History – Very Brief

Dr. Emil Christian Hansen

- One of the first directors of the Carlsberg Laboratory
- Prompted by the exporting of beers to foreign markets
 - Greater need for micro stability in beer
- Diluted suspensions of yeast in test tubes in sterile wort over and over again until he was able to isolate colonies of yeast grown from a single cell
- Thus eventually isolating a pure lager strain - 1883
 - Carlsberg was the first commercial brewery to brew using a pure yeast culture



LAGER

VS.

ALE

- Helles Lager
 - OG: 11.0-12.4°P
 - FG: 2.1-3.1°P
 - IBUs: 18-25
 - SRM: 4-5.5
- Dunkel Lager
 - OG: 11.9-13.8°P
 - FG: 2.6-3.6°P
 - IBUs: 16-25
 - SRM: 15-20

- Golden/Blonde Ale
 - OG: 11.2-13.8°P
 - FG: 2.1-4.1°P
 - IBUs: 15-25
 - SRM: 3-7
- Brown Ale
 - OG: 10-12.4°P
 - FG: 2.6-4.6°P
 - IBUs: 15-25
 - SRM: 12-25



So What's the Difference?

- Ester Profile
- Yeast Flavor Characteristics
- Sweetness and Crispness
- Drinkability



Knockout/ Aeration

- Oxygen!! – Depending on temperature of KO and set up(stone or not) you can over-oxygenate
- KO Colder 2°C (4°F) colder than you set your fermenter
 - By knocking out warmer and letting fermentation begin rapidly and then turning down to lager ferment temperature esters have already been made!
- If you cannot KO that cold, get it as cold as possible (if you trust your sanitation practices and pitch enough healthy yeast you can wait to pitch up to 6hrs). You shouldn't have to worry too much about DMS, especially if you decocted



Yeast Selection/ Pitching

- 2124: Bohemian Lager/WLP 820: Oktoberfest Lager Yeast - **Weihenstephan 34/70**
- 2206: Bavarian Lager/WLP 830: German Lager Yeast - **Weihenstephan 206**
- 2278: Czech Pils - **Pilsner Urquell-D**
- Target Pitching
 - 1.5×10^6 cells per mL per degree plato (beers 15°P and below)
 - i.e. 18×10^6 cells per mL for a 12°P beer
- Very difficult to over pitch a lager
- Make a Starter! 2L (20L batch)

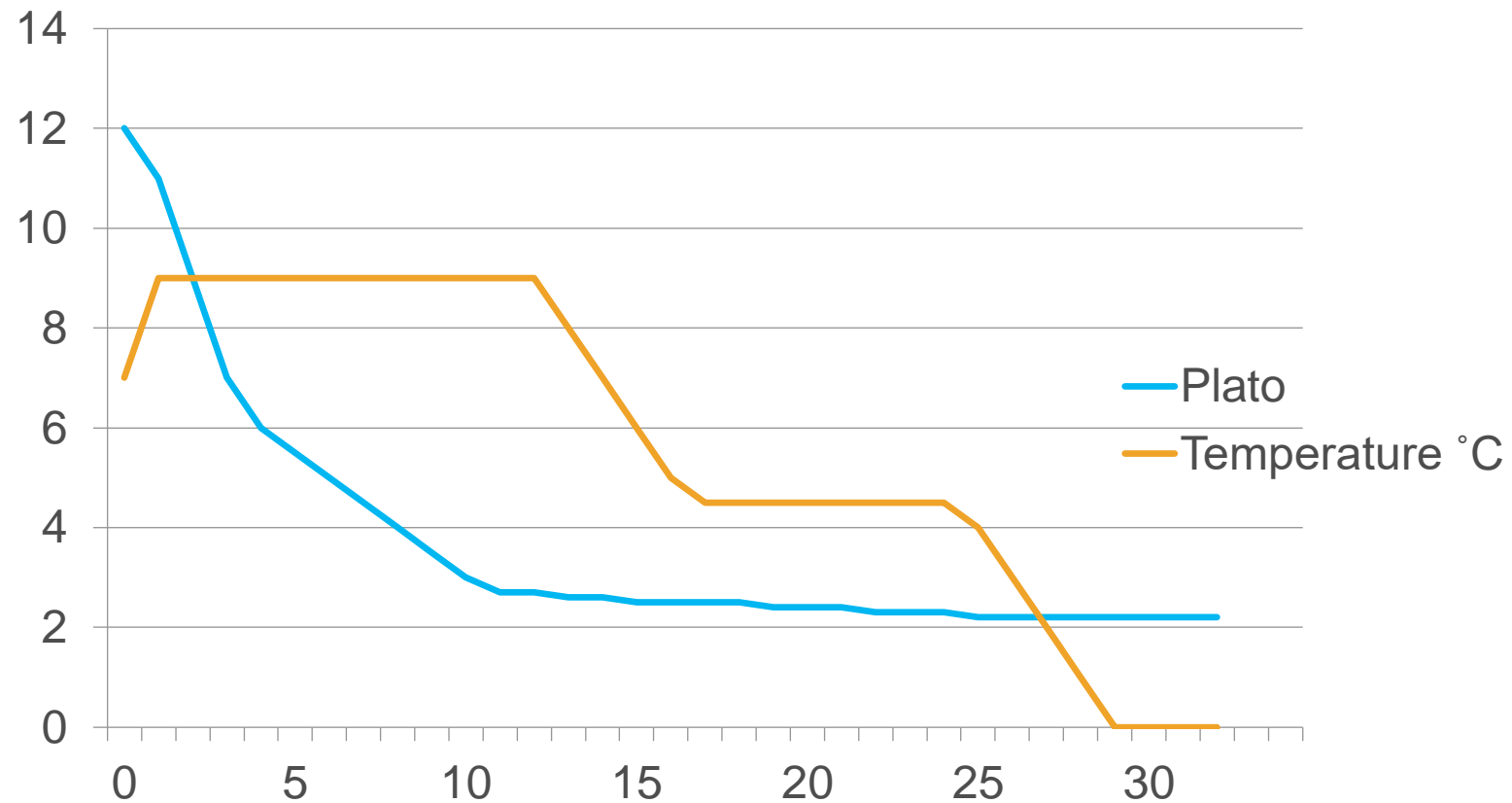


Sulfur and Lager Yeast

- Ale < American Lager < German Lager
- Some sulfur is appropriate and actually desirable in small quantities
 - SO_2 – Sulfur Dioxide
 - Struck match
 - Naturally occurring from fermentation
 - Natural preservative
 - More prevalent with colder fermentation
 - H_2S – Hydrogen Sulfide
 - Who had the egg salad for lunch?
 - Stressed yeast or unwanted microbes



Ideal Fermentation - 12°P Helles



Fermentation – “Primary”

- Lag Phase – This is a good thing!
 - Should see activity 8-16 hours after KO
 - Gentle activity – Should not be bubbling like an ale ferment
- “Primary” Fermentation – 8-11°C (46.4-51.8°F)
 - Higher temperatures result in higher esters and more fusel alcohols
 - De Clerck’s Rule of thumb – Primary fermentation 8-12 days
 - If it takes longer then increase the fermentation temp
 - If it takes shorter then decrease the fermentation temp
 - Avoid sharp changes in temperature





Fermentation – “Secondary”

- “Secondary” Fermentation –
 - Slow and steady
 - No Diacetyl rest
 - Defeats the purpose of true lagering
 - No need if you pitch cold
 - More “mellow palate”
- Spunding
- 1 Week for every degree Plato +1
- Do not “crash”
 - Yeast love a change of scenery, beneficial to get it off the yeast cake
 - Once near terminal gravity – turn down at a rate of $1^{\circ}\text{C}(2^{\circ}\text{F})/\text{day}$ until at 4.5°C (40°F) leave for 7-10 days
 - Continue to turn down beer at a rate of $1^{\circ}\text{C}(2^{\circ}\text{F})/\text{day}$ until $0^{\circ}\text{C}(32^{\circ}\text{F})$

Clarifying

- Drinkability increases with clarity (personal opinion)
 - Flavor of yeast
- Traditional finings can be effective however only weakly attracted to lager yeast
- If left to lager for a sufficient amount of time under pressure you can get a pretty darn bright beer
- Careful with homebrew scale filters – Oxidation is worse than a slightly hazy beer



Lagering: “To Store”

- Purposes
 - Allows yeast and other matter to settle out – CLARITY!
 - To saturate the beer with CO₂ by secondary fermentation – natural carbonation
 - Improves flavor
 - Maintains beer as far as possible in the reduced state and prevent oxidation



Papers/Articles/Books/Thanks

- David Bryant – Brewing Science Institute
 - “*Lager Yeast and Fermentation*” (Lecture)
- Jean De Clerck
 - “A Textbook of Brewing”, Volume I
- Steve Holle “Textbook of Brewery Calculations”
- Greg Noonan “New Brewing: Lager Beer”
- MBAA Practical Handbook for the Specialty Brewer
 - Volume 1: Raw Materials and Brewhouse Operations





Thank You! Questions?

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