JACK'S ABBY
CRAFT LAGERS

VERMONT CRAFT BREWERS CONFERENCE 2024

MODERN LAGER BEER

Progressive Methods with Traditional Roots

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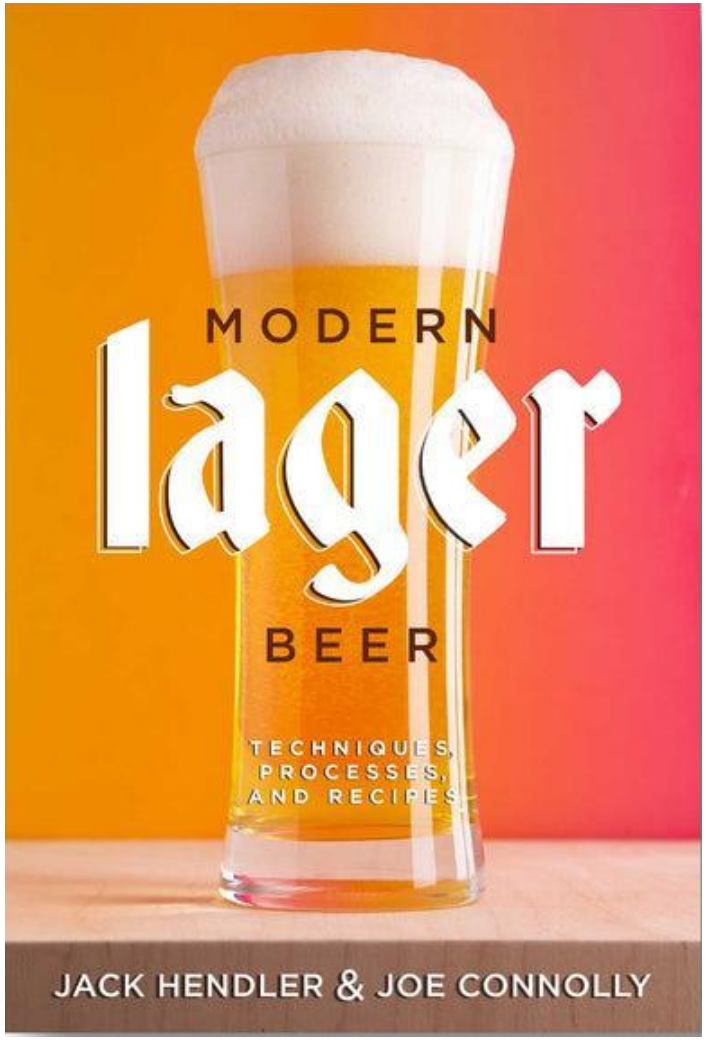
MODERN LAGER BEER: TECHNIQUES, PROCESSES AND RECIPES

We wrote this as a resource for craft brewers looking to make great lager beer.

In this book, we address many of the myths and misconceptions that surround lager beer.

We explore “traditional” practices, their origins and how they are performed by modern brewers.

These practices have come to define many of our perceptions of lager beer.



MYTHS & MISCONCEPTIONS IN LAGER LAND

Huppendorfer Vollbier defies easy description

Pilsner is somehow distinct from lager

Lager is always clean & crisp. Crispy boys.

There's no yeast character in lager. Is lager cleaner than ale?

Traditional methods of lager production, like decoction mashing, are obsolete or too complicated.

Often defined by process over raw materials. But were processes first developed by raw materials.

CHALLENGING THESE MISCONCEPTIONS BY LOOKING TO THE PAST

The dominance of pale lager is a story intertwined with the industrial revolution.

While pale, dry lagers may have taken the world by storm in the 19th century, lager's roots stretch back centuries further in Bavaria.

Raw materials available to brewers shaped how and why beer styles evolved.

Mr. Klusáček sharing his beer and his expertise

BUT FIRST... WHAT IS A LAGER ANYHOW?

Though crisp, clean, pale and dry come to mind when we think of lager beer, those descriptors are reductive and can be misleading.

For our purposes, we define lager beer as beer fermented with lager yeast.

Typically, lager beer is also matured cold for a period of time after fermentation.

WHAT IS LAGER YEAST?

- Lager yeast, aka Saccharomyces pastorianus, is a hybrid of: *Saccharomyces cerevisiae* + *Saccharomyces eubayanus*
- It was likely hybridized in the mid 16th century in a wheat beer brewery
- The two main types of lager yeast are known as Frohberg and Saaz types; today nearly all breweries use Frohberg type yeasts.
- The most common strain of lager yeast is known as TUM 34/70

DRINKABILITY ACROSS LAGER CULTURES

And while lager beer spans the sensory spectrum, most lager brewers approach brewing their lagers with drinkability in mind.

Yet drinkability, *suffig* and *pitelnost* are subjective, especially within different lager cultures.

German, Czech and American lager culture have much in common; where they differ yields interesting insight.

MODERN GERMAN LAGER BEER IS HEAVILY INFLUENCED BY CENTURIES-OLD LAWS

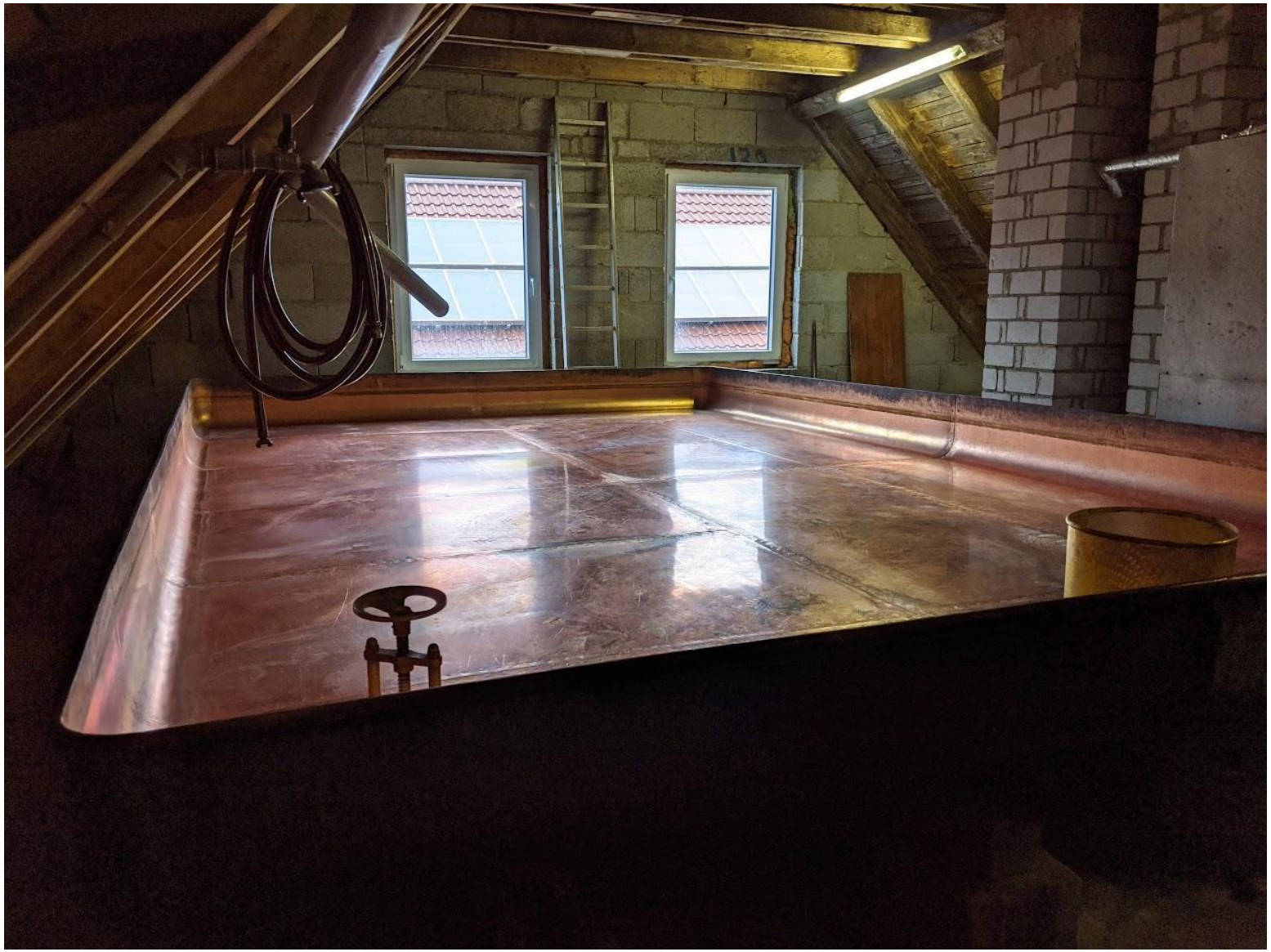
- Both were enacted as climate change shifted Bavaria from wine production to beer production
- The *Reinheitsgebot* famously limits raw materials for brewing
- The *Brauordnung* forced brewers to only brew during the winter and store beer in cellars over the summer months; it has had a lasting impact on brewing practices, albeit in subtle fashion

Beer stored this way had to be brewed to withstand long, slow, cool maturation.

While cooling technology has evolved significantly, lager is still brewed with this long maturation in mind.

Bavarian brewing technology today spans the centuries. Tradition can be a matter of circumstance.

The former cellar at Drei Kronen in Memmelsdorf



A Franconian coolship overlooked by solar panels at Brauerei Hölzlein

Franconia, in particular, is home to an incredible variety of small brewers that carry on many traditions that would be cumbersome for larger breweries.

Yet even in larger, more modern Bavarian brewhouses, elements of traditional lager production can be found.

Even in many fully automated breweries, German brewers are open fermenting, decoction mashing and naturally carbonating their beer.

THE BIRTHPLACE OF PILSNER

- The lagers of Czechia are typified by their assertive bitterness, higher residual extract and renowned *pitelnost*
- They are produced much as they have always been, with multiple decoctions, open fermentation and indigenous Czech ingredients
- The former isolation of Czechia from the West helped strengthen the unique identity of Czech beer, which has remained in its post-Soviet era
- Pilsner Urquell defines pale lager

Open fermentation at Únětický Pivovar

"České pivo" is a geographic appellation that protects the cultural significance of Czech beer.

Beers that bear this mark are double decocted, brewed with at least 80% Czech ingredients, and fermented in two stages, with a primary fermentation often in an open vessel and a longer secondary fermentation in closed pressurized vessel.

What does it mean to put "Czech Style" on a can in the US?

AMERICAN LAGER BEER BEGAN AS A TASTE OF HOME

- Immigrant brewers brought the technology and taste preferences for lager to the new world
- But brewing these styles with the raw materials available, such as six row barley, proved challenging
  - Due to the challenges, brewers quickly adapted to using adjuncts like rice and corn.
  - Familiarity with decoction helped the first generation of brewers work with adjuncts to produce beers that mimicked their European counterparts,
  - Originally, the use of adjuncts actually helped to make fuller, less attenuative beers. This eventually evolved to using adjuncts to lighten and dry out beer.

Today, American craft lager brewers produce world-class examples of lager beer inspired by traditional styles from the old world.

These styles are not only a taste of a different place, they are a taste of a different time.

American lager brewers can pick and choose traditional methods for their sensory impact.

TRADITIONAL METHODS THAT BELONG IN THE MODERN BREWHOUSE

Not all American lager brewers do all of these; some do all, most do some, a few eschew all of them completely:

Decoction
Cold Fermentation
Long Lagering
Natural Carbonation

Kettle with Schlepcetcher

DECOCTION

The pilgrim's path to Klosterbrauerei Andechs

Decoction is one of the most controversial topics in modern lager breweries. Many theories exist for its origins, including that:

- Decoction mashing was useful for gaining consistent extracts from poorly modified malts.
- Decoction mashing allowed brewers to optimize the enzymatic activity of malt by hitting different rest temperatures.
- Decoction mashing was developed at a time when brewers didn't use thermometers; the boiling portion was a way to consistently hit mash rest temperatures ideal for enzymatic activity.

DECOCTION

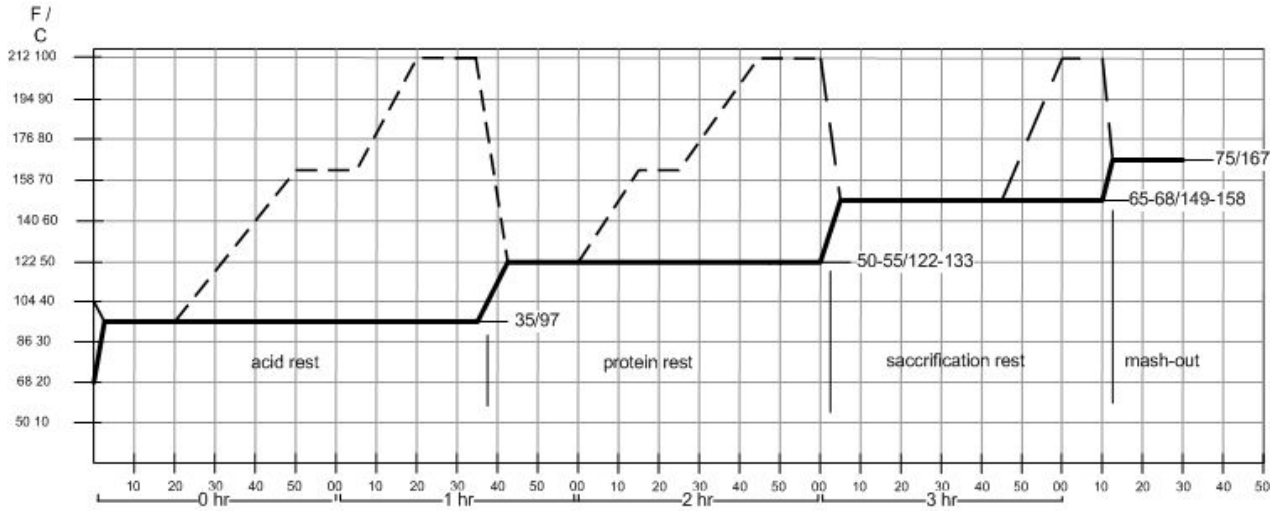
Myths and Misconceptions

- Decoction is not needed because of modern malt quality.
  - For the most part yet, but was it ever really needed?
- Decoction has no impact on beer because of modern malt.
  - Incorrect. Decoction mashing will be integral to defining the body and flavor of beer.

Table 2.5
Comparison of malt produced from Czech barley varieties, 1902–1926 versus 21st century

Malt property	Typical values for period	
	1902–1926	21st c.
Protein content (% dry wt.)	13.4–14.9	10.7–12.9
Friability (%)	46.2–57.7	77.1–91.2
β-Glucan (mg/L)	291–522	109–197
Proportion unmodified grains (%)	9–28	>2 (but closer to 0)

DECOCTION



An iconic old mash tun

The flavor impact of decoction is why this process continues. Yet raw material selection is essential; decoctions with modern malt can be detrimental.

DECOCTION

Those explanations are often used to explain decoction's obsolescence. But decoction likely did not evolve for those reasons.

- The raw materials on hand for early lager brewers is a key part of the story

- Decoction arguably leads to less enzymatic modification but significantly more mechanical modifications

Whatever decoctions true origins, its endurance is another matter. Today, decoction provides opportunities for

- Flavor impacts; the boiling of grains creates melanoidin and caramelization flavors
- Ability to change attenuation and body, use unique or heritage ingredients

MASHING - HOCHKURZ AND INFUSION

High + Short Mashing

Eliminating protein and low temperature rests

Begins to make headway in late 19th century

Adapting to changing barley varieties and malting technology

A saladin box at Bamberg Malt

FERMENTATION

Beer brewed with lager yeast is often described as “clean” or “neutral” in comparison to ale yeast, but this can be misleading, as these terms are not synonymous.

“Clean” fermentations refer to the off-flavors, or lack thereof, produced during fermentation ie. sulfur, diacetyl, etc.

“Neutral” refers to the amount (or, lack thereof) of nonvolatile flavors that remain in the finished beer ie. esters, higher alcohols, etc.

These definitions made more sense in a world where sanitary fermentations were not the norm.

MYTHS AND MISCONCEPTIONS OF FERMENTATION

Colder equals cleaner and more neutral-

Cleaner probably not, neutral in theory. Co2 concentration and yeast count arguably more important

You are more likely to get a “clean crisp” beer with certainl ale fermentation than lager. Off flavors integral to character of traditional lager.

Longer lagering equal better beer.

100% dependant on how primary fermentation is performed. Could do more harm than good.

WE LIVE FOR LAGER

Fermentation Method	Pros	Cons	Average Timeframe
Traditional Always cold 41-54°F (5-12° C)	Higher CO^2 levels at end of primary fermentation; Longer shelf life	Longer to pass VDK; Less vigorous fermentations; Greater time commitment	5-8 weeks
Modern Hybrid **C**cold start followed by raise in temperature towards end of primary ~50% of OG 41-54°F (5-12°C) start Allowed to rise as high as 64°F (18°C)	Faster vigorous fermentation helps with diacetyl reduction while limiting ester and fusel formation; Warmer temperature allows for better hop aroma extraction during dry hopping; Quicker turnaround	Potential repitch issues; Less CO^2 in solution presents problems for natural carbonation; Warmer end stage of fermentation reduces overall yeast health	3-5 weeks
Warm Fermentation Higher temperatures throughout 54-64°F (12-18°C)	Fast primary fermentation; Requires little to no lagering time; Potential for most stereotypical clean & neutral character with top pressure	Yeast health issues; Increased ester and fusel alcohol production; Natural carbonation likely impossible Top pressure needs to be applied for clean & neutral character	1-3 weeks

LAGERING: THE THING THE BEER IS NAMED AFTER

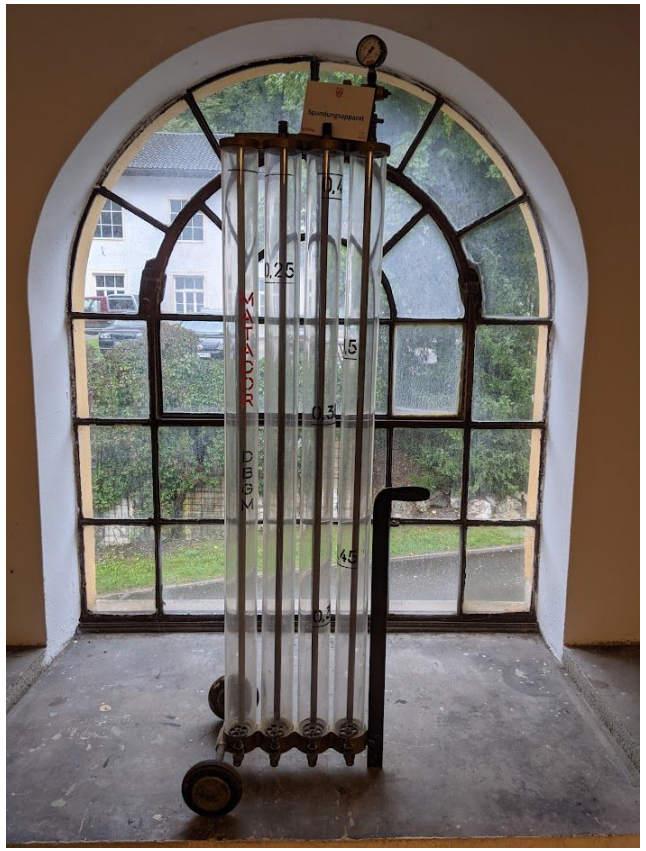
Lagering Time	Longer	Shorter
Colder primary	X	
Warmer primary		X
Naturally carbonated	X	
All malt	X	
Adjuncts and dry hopping		X
Higher strength	X	
High pitch rates		X

MODERN FERMENTATION VARIABLES

Modern brewers have the luxury of adjusting these variables to adjust their fermentation profiles

Pitch rate
Aeration
Top pressure
Free Amino Nitrogen
Temperature

CO2 AS THE FIFTH INGREDIENT



Several generations of spunding devices

Cold maturation allows lager brewers to capture carbonation created as a fermentation byproduct.

Natural carbonation results in beer with fine bubbles and good head retention.

It’s not so easy - a cellar that spunds requires constant attention.

Yet the results are rewarding and noticeable.

WE LIVE FOR LAGER

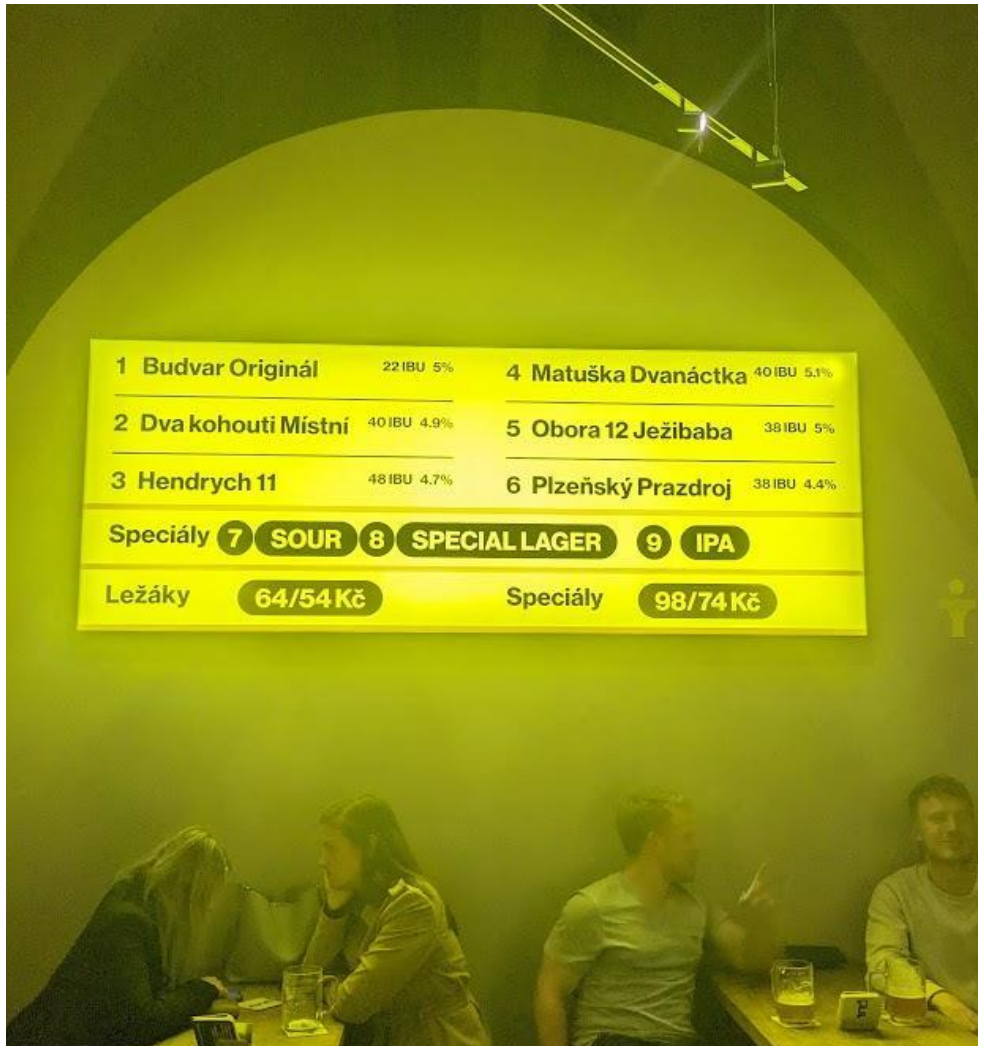
Method	Pros	Cons
Spunding (primary fermentation)	• Least amount of cellar process work • Limits contact with potential contamination or oxygen ingress • Easy to accomplish if proper testing is taking place	• Requires forced fermentations and additional lab work • Daily/hourly monitoring of primary fermentation to spund at the correct time • If spunding timing missed beer will need to be krausened or force carbonated
Krausening (secondary fermentation)	• No need to perform forced fermentations • Less lab/daily cellar data requirements • Timing of bunging not an issue • Allows for full venting of primary fermentation, which helps to remove volatiles/off-flavors faster	• Added step to reintroduce yeast and fermentables • Potentially significant extra time needed to finish second fermentation • Risk of aeration and contamination • Potential sluggish refermentation
Bottle conditioning	• Works well with higher ale fermentation temperatures • Less daily lab and cellar maintenance required to control in-tank CO_2 levels before packaging	• Mixing and consistency issues between bottles • Each and every bottle is a control point versus one control point for tank carbonation- need plan to ensure all packages are properly carbonated and passed VDK testing. • Temperature controlled space needed

NO TWO LAGER BREWERS BREW THE EXACT SAME WAY

Which is all part of what makes it great, if confusing.

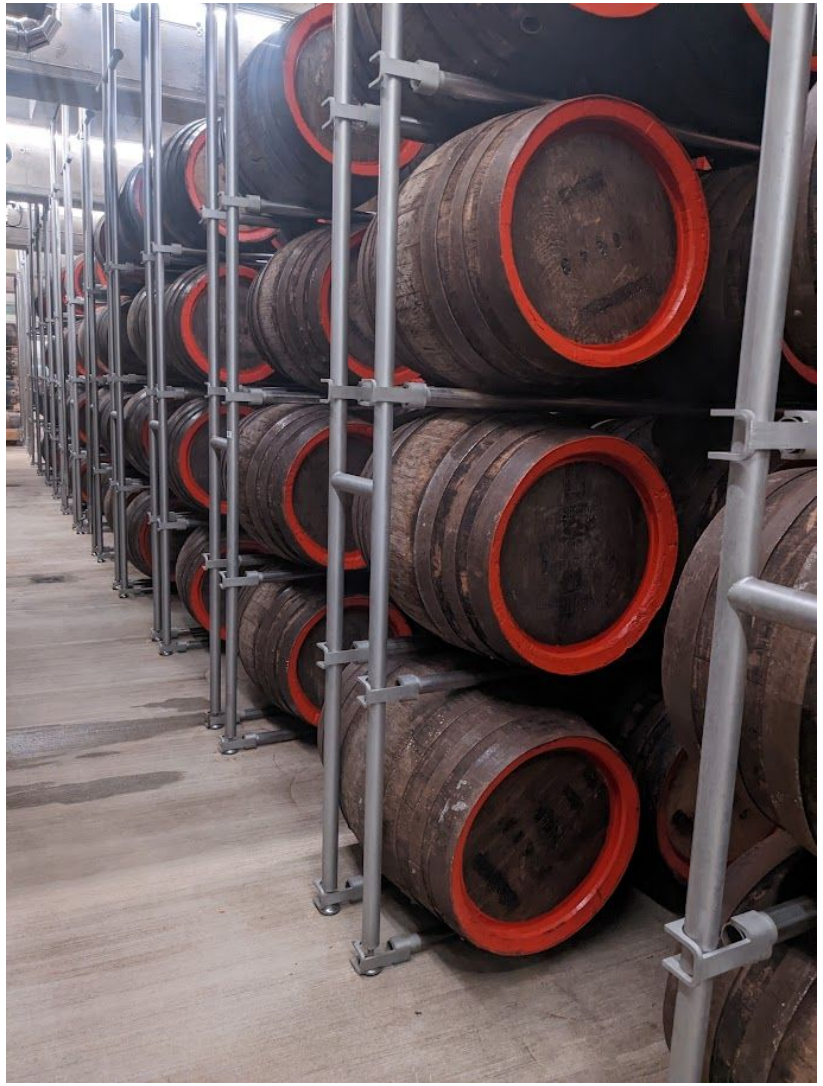
There's so much that brewers are still exploring in lager production, including:

Open fermentation
Horizontal lagering
Sediment/floatation tanks
Coolpool hopping
Wood conditioning

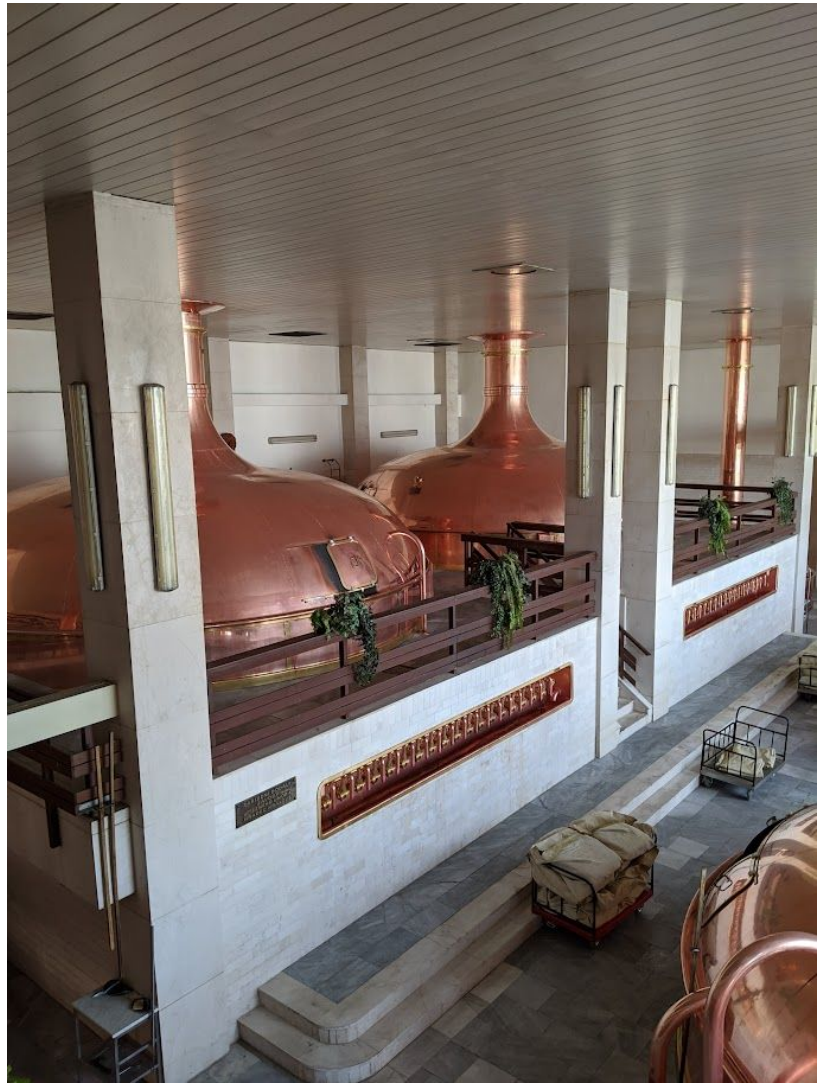


Beer selection at Pult in Prague

TRADITION & MODERNITY IN HARMONY



Barrels ready for Augustiner's Oktoberfest; the brewhouse at Budějovický Budvar



A DAWNING APPRECIATION FOR LAGER'S ROOTS

Matt and Darin Riggs after cleaning their first batch of beer corn in 2018. Their family has been farming this land continuously since 1874.

THANK YOU!

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