

WE BREW WITH YOU.™

THE OFFICIAL NEWSLETTER
OF ALL THINGS LALLEMAND BREWING



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UNDERSTANDING BIOTRANSFORMATION

Latest Research

EDITION #18



BE PASSIONATE BE LALLEMAND



Marie Coppet, Homebrew / Homewine Business Support Manager, and her friend Ian Cosier, a homebrewer, won the silver medal at the Norwich Amateur Brewers 2024 competition. Brewed with fresh Chamonix-grown hops (Alps, France) by English, French, and Argentinian neighbors. The recipe is a traditional English IPA with a rich, breadly malt backbone based on Maris Otter, Vienna, and a touch of crystal malt. LalBrew Verdant IPA™ yeast brings a little apricot, which adds another layer of interest to the herbal and gently resinous hops.

#bepassionatibelallemand

There is no question that hoppy beer styles (IPAs, pale ales, even India Pale Lagers) have been the undisputed drivers of consumer focus and brewers' innovation in the past several decades. The gradual evolution of West Coast/California IPAs and the growing number of hoppy lagers, such as West Coast Pilsners, in many countries highlight that this family of beers has staying power.

In June 2024, we released LalBrew Pomona™, a novel modern hybrid IPA strain selected in collaboration with Escarpment Laboratories (Canada). This year, we also updated and expanded our biotransformation and IPA solutions technical resources. In this edition of our *We Brew With You*™ Newsletter, we put the spotlight on biotransformation.

Within Lallemand Brewing, Technical Sales Managers Carlos De La Barra and I are part of a group focusing on the complex interactions between brewing yeast and various sensory active hop compounds. As a part of this work, we keep informed on the latest research in this space, help guide Lallemand Brewing's R&D efforts, and create relevant technical resources for brewers. Our focus has been on creating practical tools that assist brewers in building deliberate beer recipes that utilize effective combinations of yeast and hops to achieve specific sensory aims.

In this edition, we explore our ongoing research and development efforts through our collaboration with Oregon State University in the United States. You'll also find feedback from brewers using the newly released LalBrew Pomona™, an introduction to biotransformation sensory analysis, and some recipe building tips. Richard Preiss, co-founder of Escarpment Laboratories, shares his insights on this trending topic.

Happy reading!

Scott Sharp-Heward

Technical Sales Manager, New Zealand
and biotransformation toolkit champion



EDITORIAL

BREWERS' FEEDBACK FOR LALBREW POMONA™

By Eric Abbott,
Technical Support Manager

Designed specifically for modern IPA styles, this novel hybrid yeast puts a unique spin on a range of hoppy beer styles. Since LalBrew Pomona™ was launched in summer 2024, it has quickly become a mainstay in the toolbox of IPA brewers. The story of LalBrew Pomona™ started at Escarpment Labs (Canada) with the goal to create the yeast the market needs for brewing modern hop-forward beers, with robust and consistent fermentation, intense fruit aromas, and high biotransformation potential.

What makes LalBrew Pomona™ different?

The characteristics of this strain are the result of a two-step selection process in the lab. First, **Yeast Hybridization** (breeding) was used to create a new yeast strain with unique characteristics. The first parental strain was selected for its unique and intense aroma as well as its biotransformation potential. The second parent was selected for high stress tolerance, high attenuation, and robust and consistent fermentation performance. Second, the new hybrid strain underwent **Adaptive Lab Evolution** by repeated propagation in highly hopped, high ABV fermentations. This process improved stress tolerance, genetic stability, repitchability, and bio-transformation potential. (Fig. 1)

Hazies with a West Coast twist

In terms of attenuation, LalBrew Pomona™ falls somewhere between East Coast and West Coast. An intense haze and punchy fruit character gives a look and aroma profile of a hazy NEIPA, but the finish is cleaner, dryer, and more in line with West Coast IPAs. Depending on your malt bill and mash, attenuation can run anywhere from 75-84%. **Nova Runda Brewery** (Croatia) noted that since LalBrew Pomona™ ferments dryer than comparable yeasts, and it may be well-suited to Double NEIPA and other high ABV styles.

Unique flavors through biotransformation

Trials show the biotransformation potential of LalBrew Pomona™ is exceptional, and the flavor potential is seemingly limitless by varying the hop variety and addition point. Early dry hopping with high free/bound geraniol hops can increase the amount of citronellol in the beer. Late dry hopping with tropical hop varieties complements the unique ester profile of this yeast for a fruit punch character that is crisp and refreshing.

We have seen nuanced expression of mango, lemongrass, and starfruit using this strain, while others have described notes of tangerine and

pineapple. Our initial lab results have shown good terpene biotransformation potential for LalBrew Pomona™ and brewers are also reporting excellent potential for thiol biotransformation.

Sierra Nevada Brewing Co.

(USA) pointed out that when compared to LalBrew Verdant IPA™, "the aroma expression from LalBrew Pomona™ was much higher in passionfruit, guava, and other thiol compounds with undertones of citrus." In the Lallemand Brewing R&D Lab, we are beginning to unravel the unique nature of its flavor profile. The stone fruit character may be determined by aromatic lactones, which can have a significant sensory impact when combined with esters and terpenes. Lactones are not well studied in brewing yeast, so more research on this will be coming soon!

An intense haze and punchy fruit character gives a look and aroma profile of a hazy NEIPA, but the finish is cleaner, dryer, and more in line with West Coast IPAs.

What about haze?

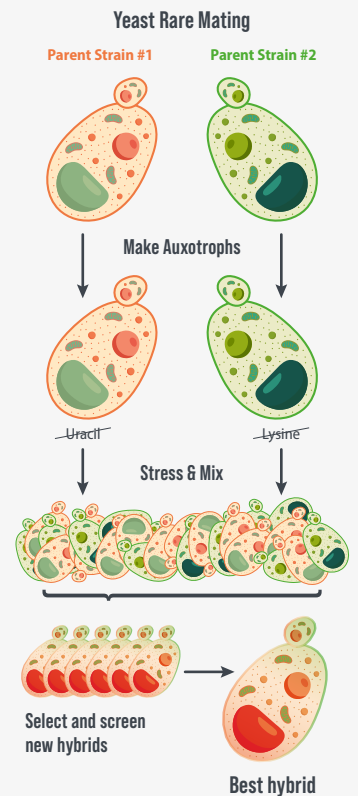
No IPA yeast assessment would be complete without a discussion of haze. Commercial trials have shown that LalBrew Pomona™ produces a consistent and stable haze. **Humalakoda Brewery** (Estonia) was pleasantly surprised by the haze formation and stability since they often struggle with haze retention in the finished beer. Note the haze produced can be removed if desired by centrifuge, filtration, or finings. This strain will also flocculate well for easy harvesting and re-pitching.

Of the 28 commercial trial partners, 93% would consider using LalBrew Pomona™ again in the future, with key selling points being haze, suitability for hoppy styles, flavor profile, and fermentation speed and attenuation. **ÅBEN Brewery** (Denmark) sums it up well: "LalBrew Pomona™ performs like LalBrew Nottingham™ but with the haze stability of LalBrew Verdant IPA™ and a prominent and enjoyable ester profile. It takes off like a rocket and performs much better than other IPA strains. As soon as the yeast came in contact with hops, it brought out apricot/ripe peach and guava aromas, with a touch of passionfruit and orange/grapefruit citrus for brightness."

Fig. 1: STRAIN DEVELOPMENT

Yeast Hybridization

Crossed a highly aromatic strain with a super robust and reliable strain



Adaptive Lab Evolution
Adapted in NEIPA wort for better biotransformation and haze



BIOTRANSFORMATION: ONGOING RESEARCH

By Avi Shayevitz,
R&D Research Scientist

One of the most significant projects we've undertaken over the past three years is a partnership with the Shellhammer Lab (Oregon State University, USA) where we explore the biotransformation capacity of selected LalBrew® Premium brewing yeast strains. These trials, led by principal investigator Ron Samia, have produced a wealth of data that promises to keep us engaged in the topic of biotransformation for the foreseeable future.

This deep-dive research aims to achieve two primary goals: first, to better understand how selected yeast strains liberate thiols in hop-forward beers; and second, to establish a research pipeline that will facilitate the evaluation of new yeast strains in the future.

Building on thiol research from oenology

Research from our colleagues in oenology has shown that specific enzymes play an important role in enhancing tropical and fruity notes in wine, notably D-cysteine desulfhydrase (E.C. 4.4.1.15). This enzyme class is vital for maintaining cysteine balance and facilitating nitrogen scavenging in various organisms, including yeasts and humans. Strains that exhibit a high rate of expression of this enzyme can significantly influence the flavor and sensory perception of various grape cultivars by liberating volatile thiols that contribute to pleasant aromas.

However, translating insights from oenology directly to brewing is not straightforward. Our project aims to systematically investigate the capacity of selected LalBrew® Premium strains to liberate aromatic thiols from malt- and hop-derived precursors, a subject that remains largely unexplored. Until recently, particularly since 2018, there were few published studies focused on this topic as it relates to beer sensory characteristics. The existing literature often reflected laboratory conditions that might not accurately represent real-world fermentation processes. Additionally, practical applications of these findings were often shrouded in secrecy or lacked robust scientific backing, leading to misunderstandings among yeast producers and brewers.

Thiols only tell one part of the tropical fruit picture, and there are clearly synergistic effects from other flavor compounds.

Testing the LalBrew® strains

In our research, we are focusing on several of our flagship yeast strains, including LalBrew Nottingham™, LalBrew Verdant™, LalBrew Diamond™, and LalBrew BRY-97™. We are evaluating how these strains liberate polyfunctional thiols under different nutrient conditions and fermentation temperatures.

Our findings reveal a strong correlation between both nitrogen content and fermentation temperature in the liberation of key thiols through a mechanism potentially unrelated to the classical D-cysteine desulfhydrase pathway. Higher free thiol levels were associated with warmer fermentation temperatures and lower nutrient levels (high adjunct, low FAN). There was also variation between each yeast strain, with LalBrew Diamond™ (lager yeast) releasing higher levels of 3SH (tropical, grapefruit, or white wine aromas) than all other strains tested.

These results have some practical implications for brewers looking to enhance thiol release in their beers. However, beer flavor and aroma is very complex with many other compounds playing a role, including esters, terpenes, fatty acids, ketones, and many others. Despite LalBrew Diamond™ showing the highest levels of 3SH in these trials, the trained sensory panel reported higher fruity and tropical aromas for beers fermented with ale yeasts. Thiols only tell one part of the tropical fruit picture, and there are clearly synergistic effects from other flavor compounds that we intend to unravel through our ongoing research.

An ongoing process

As we continue this journey into the particulars of yeast behavior and its impact on beer flavor, we remain committed to sharing our insights and findings. This small set of lab experiments is not definitive on its own, but rather the first step in the process of translating biological research into practical tools for brewers. This process requires patience, persistence, and collaboration, but the potential benefits for brewers and beer lovers alike are well worth the effort.

HOW TO IDENTIFY BIOTRANSFORMATION? THE IMPORTANCE OF SENSORY ANALYSIS

By **Scott Sharp-Heward**,

Technical Sales Manager, New Zealand and biotransformation toolkit champion

A new sensory training for modern IPA beer styles

A large challenge in the discourse around yeast and hop interactions is communicating the sensory impacts of individual compounds. For example, why should brewers be interested in creating more 'tropical' free thiols, such as 3SH, during fermentation if they don't know what this thiol smells and tastes like?

To address this challenge, we are developing a Biotransformation and Hop Compounds training using Siebel Sensory Kits. This training aims to provide a unique lexicon-building experience that differs from the typical focus on off-flavors found in other sensory kits. Instead, it will offer a series of six samples that allow brewers to smell and taste six common fruity compounds in beer that can be influenced by yeast and hop selection.

This sensory training is now in the final stages of development. From here, it will go to the global team of Lallemand Brewing Technical Sales Managers to get your feedback. Interested? Get in touch with your local Lallemand rep and see what they are planning!

Helping brewers identify biotransformation compounds

It is the complex interplay between many hop and yeast-derived sensory compounds that provides the overall impression of fruitiness (and other characters!) in hoppy beers. By communicating the sensory characteristics of specific flavor-active compounds, we hope to give brewers the tools to tailor recipes and brewing processes to maximize the desired sensory profile.

Within this training, we explore terpene alcohols, thiols, esters, and lactones. There is some narrative in the brewing context for some of these selections in the kit.

A sneak peek: Identifying biotransformation sensory compounds

The training starts with the terpene alcohol **geraniol**. This compound is perceived as sweet, floral, and fruity. Its presence may lower the sensory thresholds of other aromatic compounds such as tropical fruit thiols, thereby allowing greater aromatic expression of these compounds at lower concentrations. Geraniol can be contributed from some hop varieties in a sensory-active 'free' form or increased by yeast interaction with sensory-inactive 'bound' geraniol.

The second terpene alcohol is **citronellol**, which is typically only present in finished beer due to yeast biotransformation of geraniol. Citronellol skews towards a more citrusy/lemongrass sensory profile and is converted from geraniol at yeast strain-dependant rates.

Next is a thiol compound, **3-sulfanyhexanol (3SH)**, which is commonly described as tropical fruit, white wine, or grapefruit-like in character. As with geraniol, this compound can be found in 'free' form in some hop varieties, while some yeast strains are able to release more 'free' from the 'bound' pool contributed by some hop varieties.

Following this is the yeast-esterified form of the previous compound, **3-sulfanyhexanol acetate (3SHA)**, which shows potent guava and passionfruit characters.

The penultimate compound is a hop-derived ester, **2-methylbutyl isobutyrate (2MIB)**, which can be perceived as apple, pear, and stonefruit-like in beer. This is higher in some hop varieties and is able to be trans-esterified by yeast into a wider range of fruity compounds.

The final compound is a lactone, **gamma-nonalactone**, which is one of a family of compounds that can be present in ingredients such as hops and malt but can also be created by yeast. This family of compounds is present elsewhere in nature in oak barrels, coconut, and ripe stonefruit. We are working to elucidate how yeast metabolism influences these stonefruit aromas, and a better understanding of these pathways will help brewers enhance these aromas in their beers.

In summary, this novel sensory training will give brewers a more scientific basis by which to pick apart hop and yeast flavours and aromas in their hoppy beers, and the information to build these into recipe creation for achieving targeted sensory outcomes.

Visit our Sensory Corner
on the Siebel Institute website

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**Siebel Institute
OF TECHNOLOGY**

BIOTRANSFORMATION 101 AND RECIPES USING LALBREW POMONA™

By Eric Abbott,
Technical Support Manager

IPA is still the largest category and primary driver in growth for craft beer. Homebrewers and professional brewers alike are constantly looking for ways to differentiate their IPAs from the competition. You could increase your hop usage rates, but many brewers are leveraging biotransformation to help optimize hop aroma.

What is biotransformation?

Biotransformation refers to the process of yeast modifying hop aroma compounds during fermentation. A decade ago, biotransformation was as simple as adding hops during active fermentation. Hops + Yeast = Biotransformation. Simple, right? Our understanding of biotransformation has come a long way since then. We now understand that biotransformation depends on three main factors: Hop variety, hop addition point, and yeast strain. No surprise as yeast is responsible for the production of 42% of the aromatic compounds.

Hop varieties will vary in the quantity and relative composition of aroma compounds. The two main categories of aroma compounds are terpenes (citrus, floral) and thiols (tropical fruit). Aroma compounds may be present as a free aromatic compound or bound as a non-aromatic precursor.

Hop addition point is a balance between increasing the total biotransformation and reducing the loss of free volatiles due to CO₂ scrubbing. Hops rich in precursors should be added to the kettle, whirlpool, or early fermentation to allow yeast to interact with these compounds and release free volatiles. Hops rich in free volatiles should be added later in fermentation so that these compounds are not lost with the CO₂ produced during fermentation.

Yeast strains will vary in their ability to release free volatiles from terpene and/or thiol precursors. Different strains may also be able to convert specific terpenes or thiols into different compounds with new aromas. For example, geraniol (floral) may be converted into beta-citronellol (citrus).

Biotransformation recipes for LalBrew Pomona™

Need some examples to get you started? As part of the release of LalBrew Pomona™ in homebrew sachets, we have produced a series of [six different recipes](#)¹ that highlight the biotransformation potential of this strain. What makes these recipes special is that we go into detail about how the recipe was created, why specific hop varieties were chosen, and how the hop additions serve to maximize specific aromas in the beer.

Pacific Rim Hazy IPA promotes the citrus aroma by the release of aromatic terpenes from glycoside precursors. Watch this video featuring David Heath to learn more about [this recipe](#).²

The Rejoin IPA promotes the citrus aroma by converting geraniol to beta-citronellol and boosting hop esters.

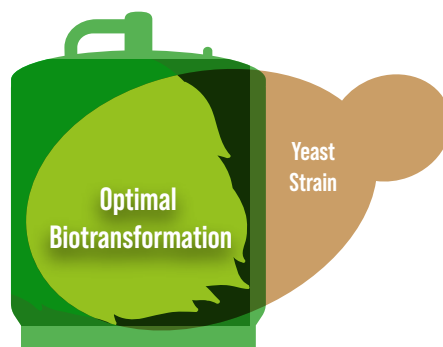
Spinning Yarns is a session IPA with New Zealand hops that pairs well with the ester profile of LalBrew Pomona™.

American Wheat Ale showcases how terpene precursors from coriander seed can increase terpene aroma in the beer.

Life's a Peach IPA shows off the peach character of LalBrew Pomona™ by pairing with hop varieties known for a peach aroma.

Peaches & Cream Triple IPA is an admittedly excessive recipe that brings everything together by promoting the release of geraniol from glycoside precursors, conversion to beta-citronellol, and selecting hops to promote tropical fruit and coconut aromas.

Are you planning to brew one of these recipes? If you do, tag us on social media with the [@lallemandbrewing](#) handle. We would love to see your photos and videos.



Find all our
LalBrew Pomona™
recipes here

<https://bit.ly/4iq9fWN>

¹: <https://bit.ly/4iq9fWN>

²: <https://www.youtube.com/watch?v=PbYCiUHLsJA>

HAVING A BEER WITH RICHARD PREISS

Co-founder of Escarpment Labs

By Molly Browning,
Technical Support Manager

We had the opportunity to sit down with Richard Preiss, co-founder of Escarpment Labs and developer of LalBrew Pomona™, to get his thoughts on all things biotransformation and what new trends brewers should look out for.

The discussion around biotransformation started with terpenes, and then everyone became interested in thiols. What is the next frontier in biotransformation?

It may be wishful thinking, but I think the next frontiers are precision and balance rather than maximizing output of one aroma compound. At this point, science has figured out how to push thiols and terpenes to extremes in beer. Now, I think the game becomes finding the right balance in the brewery to achieve targeted flavor profiles such as peach, passionfruit, pineapple, and so on. Or create entirely new flavor profiles using yeast biotransformation.

We may also see more discussion about lactones, a class of aroma compounds present in beer that has not yet received much attention.

What are lactones and why should brewers care?

Lactones are aroma compounds that are produced and modified as a byproduct of fermentation. They can originate from malt or hops. On their own, they can present as dairy or coconut notes. However, lactones are synergistic with other aroma compounds and, when they combine with esters and terpenes, they can present more complex aroma profiles such as stone fruit (peach, apricot).

We are still in the early days of understanding how different yeast strains push lactones in beer, but early data suggests there are differences among strains that might push one yeast to make a "peachier" beer than another.

What is the first thing you would recommend to a brewer looking to achieve better biotransformation?

Don't ignore your whirlpool hops! I see a lot of modern IPA recipes with a tiny whirlpool addition and a huge dry hop. Even if you're dry hopping mid-ferment, you're leaving out on a lot of biotransformation potential by skipping a heavier whirlpool. Adding hops to the end of the boil/whirlpool

will help solubilize a lot of the precursor compounds that yeast can biotransform such as bound thiols, esters, terpenes, and lactones.

Any hop high in geraniol (e.g. Centennial) can potentially present as more citrusy when biotransformed. Hops perceived as coconut-like (e.g. Sabro) can gain added complexity that pushes the profile toward stone fruit and pineapple. Hops with high levels of "dankness" (e.g. Columbus) can become fruitier.

LalBrew Pomona™ was produced through a combination of yeast breeding and lab evolution. How did each of these methods select for specific characteristics of the LalBrew Pomona™ strain?

With LalBrew Pomona™, we were deliberately trying to create new yeasts for IPA or hop-forward beers. So, the target was to develop a yeast strain with efficient fermentation, compatibility with modern hazy IPAs, and a unique flavor profile to help brewers create new beers.

We first did yeast breeding to combine two strains we liked. There was an efficient parent and a flavorful parent, basically. We did yeast breeding to generate hybrids of the two strains

and found some hybrids we liked during screening, but they missed the mark in terms of haze stability and fermentation efficiency.

That led us to follow breeding with adaptive laboratory evolution, which can be thought of as strength training for microbes. The hybrids were forced to grow in and ferment hazy IPA wort for more than 45 generations. This process selects for random mutations that give the yeasts a fitness advantage. At the end of the process, we screened the yeast candidates that made it to the end, and our favorite became LalBrew Pomona™.

[Continue reading on the next page >](#)

Even if you're dry hopping mid-ferment, you're missing out on a lot of biotransformation potential by skipping a heavier whirlpool.

If a brewer is using LalBrew Pomona™ for the first time, what are the key parameters they should consider when using this strain? Specific hops? Addition times?

I like to think of LalBrew Pomona™ as Swiss army knife for hoppy beers. There are a lot of different things it can do in terms of flavor production. That being said, we've seen some winning combos based on beers we and our clients have brewed:

- LalBrew Pomona™ + Simcoe, HBC1019, Vista = Peach
- LalBrew Pomona™ + Citra, Strata, Cashmere = Pineapple
- LalBrew Pomona™ + Nectaron, Nelson Sauvin, Rakau = complex tropical fruit and wine-like

You can also experiment with other ingredients and styles that have biotransformation potential. For example, coriander seed can produce surprisingly potent lemon-lime aromas when biotransformed by a yeast like LalBrew Pomona™.

Crystal ball gazing, what trends do you think brewers should look out for in the coming years?

I personally want to see more low-ABV beers as an option for mindful consumers. Non-alc beers are really hard to nail and involve a lot of compromises in taste. I think many consumers (myself included) would support more commercial beers in the 2-4% ABV range if brewers put effort into making them taste good. Most ultra-session beers need improvement in flavor and body.

What is your secret superpower?

I bake a lot of bread as a hobby. Several hundred loaves in, I think I'm close to perfecting a focaccia recipe. Yes, even my hobby involves yeast.

Richard Preiss, co-founder of Escarpment Laboratories, is an active brewing scientist and long-time homebrewer. At Escarpment, Richard's focus is on translating new research into exciting products and knowledge for brewers. Richard loves to help their team and the brewers we work with to solve problems, overcome challenges, and unlock efficiencies.

Breaking News
LALLEMAND BREWING AND EVODIABIO TEAM UP!



We are thrilled to announce a partnership between Lallemand Brewing and EvodiaBio, a start-up specializing in yeast-derived aroma solutions. You will soon discover an innovative solution set to revolutionize the brewing industry by enhancing the flavor profile and sustainability especially of no-alcohol beers (NABLABs).

We are committed to providing innovative solutions for NABLABs including the maltose-negative yeast LalBrew® LoNa™ for ultra-low attenuation fermentation and the inactivated specific yeast ISY Enhance™ to improve body and mouthfeel.

As part of this strategic partnership, Lallemand Brewing will leverage its extensive distribution network and direct sales capabilities to bring this new product to market.

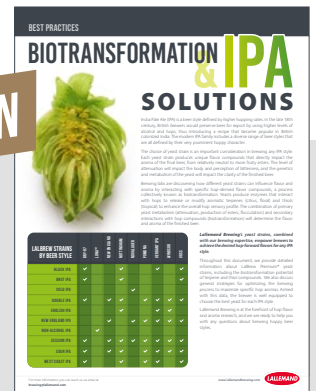
Stay tuned for more updates as we embark on this exciting journey to transform the NABLAB market with sustainable and flavorful yeast-based solutions.

Breaking News
BIOTRANSFORMATION BEST PRACTICE

Recent research mentioned in our previous articles revealed how various LalBrew® Premium yeast strains can significantly influence the flavor and aroma of beer through a process known as biotransformation.

During this process, yeast enzymes interact with specific hop-derived compounds, transforming non-aromatic substances into aromatic flavor compounds. This transformation enhances the beer's overall sensory profile, making it more flavorful and aromatic.

Our R&D and technical teams recently updated the Best Practices for Biotransformation and IPA Solutions. This tool helps brewers understand the biotransformation process and achieve the desired flavor profile with yeast and hop combinations.



Download our best practice guide
<https://bit.ly/3Z52YrK>

DID YOU KNOW...

...that healthy yeast is important for maintaining stable haze?

When yeast is stressed or lacking nutrients, it can release proteases into the beer that will break down haze-positive proteins. Using nutrients, ensuring a proper pitch rate, and following best practices for yeast handling/repitching will reduce stress and help prevent your hazies from dropping clear on the shelf.

