July 2013

San Joaquin Worthogs
HOMEBREW CLUB NEWSLETTER

Fourteen Essential Questions About Yeast Starters

by Jamil Zainasheff,

You might have already heard your fellow brewers talking about starters and how important they are to making great beer. Proper fermentation is what sets apart great beers from just OK beers and starters can help ensure proper fermentation. Proper fermentation results in a beer with the correct appearance, flavor, body, and aroma profile. It is also clean, complete, consistent, and reproducible.

In order to have proper fermentation, you must have the right amount of clean, healthy yeast to ferment your wort. If you're a professional brewer, with plenty of yeast every few days, this isn't too hard. If you're an amateur brewer, you're often starting with a new pitch of yeast (from a White Labs Pitchable Yeast vial or a Wyeast ACTIVATOR™ 125 XL Smack Pack) and employing a starter can often improve the performance of that yeast.

Even though many brewers are using starters, most still have questions about the "best way" to make and use them. The answers to these questions are not only based on my experience and lab work, but from conversations with David Logsdon, Founder/Owner of Wyeast Laboratories, Inc., Greg Doss, Wyeast Laboratories Microbiologist, and Neva Parker, White Labs Inc. Laboratory Manager. I would also like to thank Graham Sanders for his extensive feedback on this article.

Q: Do I always need to make a starter?

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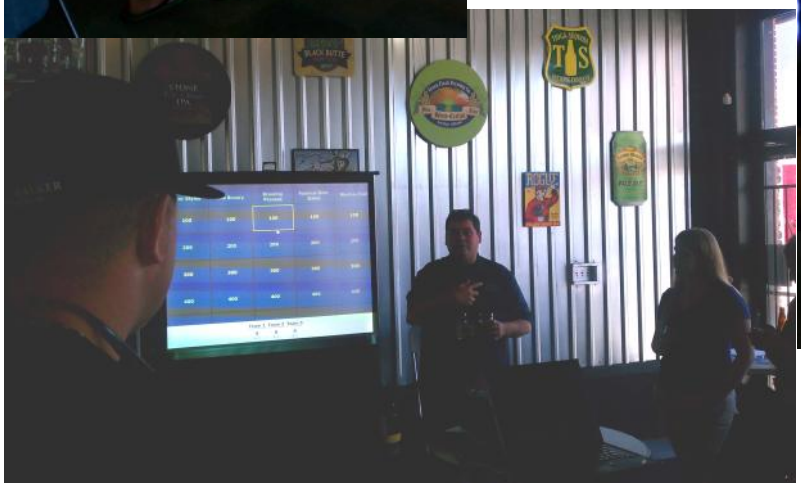
Next Meeting: August 17th
Location: Tioga-Sequoia Brewery
746 Broadway Street
Fresno, CA 93721

Schedule:
12:00 Joint Meeting with TCHOPS

Please bring a side dish to share at the potluck and some homebrew or some nice commercial brew to share with the other beer lovers. Be sure to label the homebrew you bring so you get the recognition you deserve!

July Meeting

We had a really great July meeting at Das Bierhaus! Some very memorable beers were available commercially and home-brewed. I especially enjoyed the Deschutes Fresh Squeezed IPA and a Homebrewed IPA by an unknown brewer. A big thanks to Christie of Das Bierhaus for hosting and providing some great BBQ for the meeting.



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No. However, in many cases, making a starter will provide better fermentation. You should always make a starter if you suspect the viability (overall health) of your yeast might be low. If you have an old vial or pack of yeast or the yeast has been left out warm for an extended period of time (for example yeast in shipping for several days), you should make a starter.

You can also make a starter to grow a smaller amount of yeast into an appropriately sized pitch for the batch you're brewing. Larger volume batches, higher gravity worts and lager fermentations require more yeast. Of course, you can pitch more containers of yeast or repitch yeast from a previous batch to get good results, but starters from a vial or pack are an excellent solution.

Besides the popular 125 ml ACTIVATOR™ Smack Pack, Wyeast sells the PROPAGATOR™ 50 ml XL Smack pack, which they designed for brewers growing up their own pitch of yeast. The package includes instructions on how to make a starter, which is required if you're making a 5 gallon (18.9 liter) batch of beer.

Q: When shouldn't I make a starter?
You should never make a starter if you can't handle the steps in a sanitary way or you can't provide proper nutrition for the yeast. The primary focus of a starter should be yeast health.

Also, for some small batches or low gravity beers such as an ordinary bitter, there is a very slight chance you might end up over pitching if you get carried away. High pitching rates can result in a less than ideal fermentation profile (i.e., low or unexpected esters, yeast autolysis flavors, poor head retention) as compared to a properly pitched batch. This is also a consideration in beer styles where the yeast derived flavors are foremost, such as Bavarian style wheat beers. Though I don't concur, a number of experts believe it is better to pitch at lower rates when brewing these styles of beers to increase ester formation.

Another case where you generally don't want to make a starter is with dry yeast. It is usually cheaper and easier to just buy more dry yeast than it would be to make a starter large enough for most dry yeast packs. Many experts suggest that placing dry yeasts in a starter would just deplete the reserves that the yeast manufacturer worked so hard to build into their product. For dry yeasts, just do a proper rehydration in tap water, do not make a starter.

Q: How do I make a starter?
A starter is easy to make. It is like a mini-batch of beer, with the focus being yeast growth and health, not drinkability.

You'll need a clean, sanitized container able to hold the starter plus some head space, aluminum foil, dried malt extract (DME), yeast nutrients, and some water.

When making starter wort, keep the starting gravity between 1.030 and 1.040 (7 - 10°P). You do not want to make a high gravity starter to grow yeast. As a ballpark measurement, use about 6 ounces (by weight) of DME to 2 quarts of water. If you're working in metric, it couldn't be easier. Use a 10 to 1 ratio. Add 1 gram of DME for every 10 ml of final volume. (If you're making a 2 liter starter, add water to 200 grams of DME until you have 2 liters total.) Add 1/4 teaspoon of yeast nutrient, boil 15 minutes, cool, and add yeast.

Using an Erlenmeyer flask made of borosilicate glass (such as Pyrex or Bomex) it is even easier. Just put the DME and water in the Erlenmeyer flask, put a piece of aluminum foil over the top, drop in any nutrients you desire, and put the flask directly on the stove burner. Boil gently for fifteen minutes, and then let it cool.

If you have oxygen handy, you should add oxygen to your starter or at the very least shake it every few hours to increase the amount of oxygen available to the yeast. If you have a stir plate, that works even better. A stir plate provides good gas exchange, keeps the yeast in suspension and drives off CO2, all of which increases yeast growth (around 2 to 3 times as much yeast as a non-stirred starter). Keep the starter around room temperature (72°F, 22°C).

Every time you make a starter, keep in mind there the four main factors that affect yeast growth and health: nutrients, temperature, sugars, and pH.

Key nutrients include oxygen, zinc, amino acids, and nitrogen. Oxygen is one of the things many brewers ignore, yet it is critical to the survival and growth of yeast. You should do what you can to provide oxygen to the yeast, as it tends to be the most limiting factor for most starters.

Use an all malt wort for starters. The sugar in the starter needs to be maltose, not simple sugar. Yeast that have been eating a lot of simple sugars stop making the enzyme that enable it to break down maltose, which is the main sugar in wort. The yeast quickly learn to be lazy and the ability to fully attenuate a batch of beer suffers.

The pH of a starter needs to be around 5 pH, but if you can't test it, don't worry. Typical wort ranges between 4 to 6 pH, so use a high quality DME and it will be OK.

When adding yeast to the starter, work in a draft free area and try to keep the containers open as short a time as possible.

The design of the White Labs packaging keeps the yeast out of con-

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2013 "Worthog of the Year"
Official Rules

Dear Worthogs:

"Worthog of the Year" (also known as WotY) is an honor bestowed upon an individual who brews the best beers through a single year. To honor this member, a trophy is given to the highest scoring Worthogs to highlight their outstanding brewing skills. Please read below for official rules.

Official Rules

1. Only actively paid members may participate in the competition.
2. The competition consists of brewing 4 different styles of beer between the dates October 31st and the September general meeting.
3. Each contestant must register their beers at http://sjworthogs.org/woty
4. Competition entries will **only** be accepted at the general meeting listed below **no later than 12:30 pm**. Beers will be inventoried by the current acting Executive Vice President or any person on the board who will not be participating in the judging.
5. All entries must be submitted in two - 12 oz. or higher bottles with the competitors name clearly printed on them. You may also use the bottle ID generated for you when registering your beer at http://sjworthogs.org/woty. Any bottle that does not specify a first and last name will be disqualified.
6. Each candidate may only enter in one beer per style.
7. All entries will be judged by two or more judges based on BJCP guidelines using the official BJCP score sheet (http://www.bjcp.org/docs/SCP_BeerScoreSheet.pdf). Entries that are out of style will be disqualified.
8. Depending on the number of judges, scores will be averaged between the score sheets to determine the value for that particular entry. For example; judge one gives 40 points and judge two gives 42 points. Your official score value for that competition will be 41. The participant with the highest cumulative amount of points at the end of all four competitions will be awarded WotY.
9. The styles for 2013 and their dues days are as follows:
    a. **Dry Stout (Category 13A)** will be due at the **January** general meeting.
    b. **Specialty Beers (Category 23)** will be due the **March** general meeting.
    c. **American Pale Ales (Category 10A)** will be due at the **June** general meeting.
    d. **Saison (Category 16C)** will be due at the **September** general meeting.
10. The Worthog of the Year winner will be awarded the trophy at the annual Hogtoberfest event.

May the best Worthog win!

Sincerely,

Board of Directors

Worthog of the Year Update

Here's how the competition has been shaping up so far.

The top 5 Dry Stouts from the January Meeting were:

1.	Chris Steinkraus	39.33 points
2.	Scott Bailey	37.66 points
3.	Jeff Dashjian	33.33 points
4.	Matt Humann	33 points
5.	Lawrence Washington	29.66 points

The top 5 Specialty Beers from the March meeting were:

1.	Sean Railing	37.3 points
2.	Matt Humann	35.7 points
3.	Marshall Schott	35.3 points
4.	Chris Steinkraus	34.7 points
5.	Scott Bailey	34.3 points

The top 5 Pale Ales from the June meeting were:

1.	Sean Wood	40 points
2.	Chris Steinkraus	38 points
3.	Sean Railing	36.5 points
4.	Matt Humann	35 points
5.	Scott Bailey	32 points

The total points for the top 5 overall scores after 3 Categories are:

1.	Chris Steinkraus	112.03 points
2.	Scott Bailey	103.96 points
3.	Matt Humann	103.70 points
4.	Sean Railing	102.46 points
5.	Sean Wood	98 points

The Final WotY Category: Saison

Be sure to register to enter the next style, Category 16c—Saison. Entries must be entered through our new competition website, you can register and enter your beer at http://www.sjworthogs.org/woty/ . Entries must be entered through the website to be judged in the competition. Please bring your entries no later than 12:30 to our September general meeting. See page 4 for rules and more info

Become a BJCP Judge

Ever wanted to know more about beer, be a better brewer, and help out other brewers? Then becoming a BJCP Judge is for you. Check on the BJCP website at http://www.bjcp.org/. The first step is to download the study materials, study and take the online **BJCP Beer Judge Entrance Examination.** Once you pass the exam you will need to take the **BJCP Beer Judging Examination** in the next twelve months. If we have at least 8 people pass the entrance exam Tom Pope can facilitate the Judging Exam!

Turn in your used White Labs Vials at the next Meeting...when we get 5000 vials Chris White will brew with us!

Bencomo's Homebrew Supplies

Bencomo`s Homebrew Shop was started in 1991 in Mike's Liquors on north Palm Ave. Julian Bencomo has been brewing since 1988, is a nationally recognized beer judge, and has won numerous awards for his beers. The shop is located on the northeast corner of Olive and Arthur between Palm and Fruit at . Hours of operation are M-F 10-4; Sat. 9-5 we also take appointments after hours and on Sundays. Bencomo`s is a full service shop with great selection of grains, hops, yeasts, extracts and equipment. Homebrewing advice is always just a phone call away. Phone 559-486-3227

Address: 234 W Olive Fresno

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tact with the outside surfaces of the vial. However, it is possible for dust borne wild yeast and bacteria to settle on the protruding lip near the top, so it doesn't hurt to sanitize the vial to keep any settled dust from dropping into your starter. If you shake the vial to loosen the yeast inside, let it rest a few minutes and slowly open the top to prevent excessive foaming.

It isn't required to "smack" the Wyeast pack before making a starter. The yeast is not in the little part that gets popped, but rather in the main pack. However, the liquid inside the little pack is a high quality nutrient and sugar source. It also helps rinse the yeast out from the main pack. Even though the chance of contamination while pouring is extremely low, you should sanitize the outside of the Wyeast pack before opening, as well as scissors if you use them.

Q: Should I add hops when I make my starter wort?
No. It doesn't hurt, but it really doesn't help much either. The antibiotic effect is minimal. Remember, the final product of a good starter is healthy yeast, not beer. It is better to have less material floating around, less expense, and less steps to worry about.

Q: Should I add oxygen to my starter?
Yes. You'll get far healthier yeast and far more yeast growth if the yeast have oxygen throughout the process. Adding oxygen at the beginning helps, but the most effective starters provide a continuous source of oxygen. Oxygen is critical to yeast growth. Not providing any oxygen to the yeast can have a long-term negative impact on yeast health. Yeast use oxygen to synthesize unsaturated fatty acids and sterols, which are critical to creating a healthy cell membrane and good cell growth. With oxygen present, yeast convert sugar to carbon dioxide and water and they grow rapidly. With no oxygen, yeast create alcohol, grow far more slowly, and reach a lower total mass of cells.

There are several ways to add oxygen: intermittent shaking, a stir plate, pure oxygen, or an air pump with a sterile filter.

A stir plate is perhaps the most effective method. When using a stir plate, don't plug up the starter vessel with an airlock. A sanitary piece of aluminum foil or a breathable foam stopper is all you need. Bacteria and wild yeast can't crawl and a loose fitting cover will allow for better gas exchange.

Shaking the starter as much as possible, every hour or two, makes a large difference in the amount of yeast growth and health. With enough attention and good air exchange, shaking is just about as effective as a stir plate.

Continuous air from a pump and sterile filter can be effective too. The major drawbacks are being able to control the flow of air to prevent excessive foaming and evaporation of the starter. Shaking is just as effective as intermittent aeration with a pump.

Continuous pure oxygen from a tank or oxygen generator is both expensive and unnecessary.

Q: How much yeast or how big a starter do I need?
You should always know how much yeast you need to pitch for a given batch of beer.

According to both White Labs and Wyeast, a White Labs Pitchable Yeast vial and a Wyeast ACTIVATOR™ 125 XL Smack Pack both contain an average of 100 billion cells and are enough to pitch directly into 5 US gallons (18.9 liters) of an ale wort at 1.048 SG (12° P). This is a pitching rate of 5.3 million cells per milliliter, which is close to the pitching rate many professional breweries begin with when starting a new pitch of ale yeast. This rate works well because the health and vitality of fresh laboratory cultured yeast are superior to yeast harvested from normal fermentation. Both companies also concur that higher gravity worts, especially once they exceed a specific gravity of 1.060 (15°P), larger wort volumes, and lager fermentations all require higher pitching rates (or a starter) for optimum results.

You might have heard that when using yeast harvested from a previous fermentation, the optimal pitching rate for ales is 6 to 10 million cells/ml and 10 to 15 million cells/ml for lagers. That is a generally accepted ballpark, but it doesn't take into account the starting gravity of the wort. Higher gravity worts require more yeast and lower gravity worts require less. You want to pitch around 1 million cells of viable yeast, for every milliliter of wort, for every degree Plato. A little less for an ale, a little more for a lager. In his book, An Analysis of Brewing Techniques, George Fix states that you need to pitch 0.75 million cells per milliliter for an ale and 1.5 million cells per milliliter for a lager. While these rates are for repitching yeast harvested from fermentation, I have found that they work well for both repitching yeast and when using laboratory cultured yeast that has been subjected to less than optimal conditions since leaving the manufacturer.

Here is the simple math to calculate the number of cells needed.
For an ale, you want to pitch around 0.75 million cells of viable yeast, for every milliliter of wort, for every degree Plato.

(0.75 million) X (milliliters of wort) X (degrees Plato of the wort)
There are about 3785 milliliters in a gallon. There are about 20,000 milliliters in 5.25 US gallons.
One degree Plato is close to 1.004 of specific gravity (SG). Just divide the decimal portion of the SG by 4 to get the approximate degrees Plato (e.g., 1.060 is 15°P).
The proper amount of yeast for 5.25 US gallons of 1.060 wort is

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around 225 billion cells if you are pitching 0.75 million per milliliter. (750,000) X (20,000) X (15) = 225,000,000,000

Another way to put it, you need about 3 3/4 billion cells for each point of OG when pitching into a little over 5 gallons (20 liters) of wort. Double that number for a lager.

With each vial or pack having around 100 billion cells, you would need two vials or packs (approximately 200 billion cells) to get close to that rate, if you didn't want to make a starter.

In general, a two liter starter doubles the amount of yeast in a single vial or pack. For the above example, you would only need one package of yeast if you made a two liter starter. To make it easier to figure out how much yeast you'll get out of a starter, Wyeast created a calculator that estimates the amount of growth from a given starter size. Wyeast plans to have their Wyeast Pitch Rate Calculator available for customers soon at http://www.wyeastlab.com.

You might ask why not pitch as much yeast as possible? There is also an upper limit to how much yeast you should add. Logsdon says, "I try to stay within 20% of my ideal pitch rate and I prefer to slightly under pitch rather than over pitch. This causes more cell growth, more esters, and better yeast health. Over pitching causes other problems with beer flavor, such as a lack of esters. Changes in the flavor profile are noticeable when the pitch rates are as little as 20% over the recommended amount."

An easy way to determine how much yeast you need is to use for a given batch of beer is the free Pitching Rate Calculator™ at http://www.mrmalty.com. The calculator can determine the proper amount of yeast for your batch and how big a starter you need to grow that yeast.

Q: Does a starter need to be kept at the same temperature as it is going to ferment the batch of beer later?
No, but there are practical limits to how high or low you can go.

Warmer starters (up to 98°F, 37°C) equal more rapid yeast growth, but using these very high propagation temperatures negatively affects the viability and stability of the resulting yeast. Very rapid growth or excessive growth can result in weaker cell membranes due to lower unsaturated fatty acid concentrations. Lager yeasts tend to be especially sensitive to high temperatures.

The cooler you ferment the starter (down to the planned fermentation temperature for the main batch) the slower the yeast growth, but the yeast can be healthier than yeast coming from a high temperature starter.

Keep starters between 65°F (18°C) and 75°F (24°C). A temperature around the low 70s (72°F, 22°C) strikes the best balance for the propagation of yeasts. Lager yeast starters can be kept a few degrees cooler and ale yeasts can be kept a few degrees warmer, but this temperature strikes a good balance of yeast health and efficient propagation for both types of yeast.

If you are going to pitch the starter at high krauesen, it is best to keep the starter within 5 degrees Fahrenheit (3°C) of the wort temperature of the main batch. Pitching a very warm, active starter into cold wort can stun the yeasts and with lager yeasts this can cause a higher incidence of petite mutants, which can negatively affect attenuation, flocculation, and increase hydrogen sulfide production.

You can add small amounts of cool wort to the starter over time, to bring the temperature down gradually, but it is really better to keep everything closer to fermentation temperatures from the beginning. Any time yeast sense a big drop in temperature, they slow down and drop out.

Q: At what point do I pitch the starter into the wort?
A great deal of discussion rages over this topic. Should the starter be fermented completely, the spent liquid decanted, and the yeast pitched or should the entire starter be pitched when at the height of activity?

Most yeast experts say that when propagating yeast, moving at high krausen is optimal. The time of high krauesen can range anywhere from a few hours to twenty-four or more. It depends on the amount of yeast added to the starter wort, yeast health, temperature, and several other factors.

Doss says a starter made from an XL pack of yeast into 2 liters of wort will reach its maximum cell density within 12-18 hours. If you're starting with a very small amount of yeast in a large starter, it can take 24 hours or more to reach maximum cell densities. For the average starter, let's just say that the bulk of the yeast growth is done by 12-18 hours.

I like to pitch starters while they're still very active and as soon as the bulk of reproduction is finished, usually within 12 to 18 hours. This is really convenient, because I can make a starter the morning of the brew day or the night before and it is ready to go by the time the batch of wort is ready.

Q: I've heard that too small or too large a starter can be bad for the yeast. How is that possible?
Parker says putting a fresh vial of yeast into 500 ml of wort and letting such a small starter go to completion can actually leave the yeast less ready to ferment a batch of beer. The yeast do not rebuild their reserves and have very little increase in cell mass.

The minimum starter size for significant yeast growth from a vial or pack of yeast is 1 liter. One vial or pack into 1 liter results in approximately a 50% increase in cell mass.

Q: If I'm making a high gravity beer, shouldn't I make a high gravity starter so the yeast become acclimated?

No. In general, starter wort should be between 1.030 and 1.040 (7 - 10°P). If you're trying to revive a stressed yeast, like culturing up yeast from a bottle conditioned beer or from an old slant, use a lower gravity starter wort around 1.020 (5°P). Lower gravity starters are easier on the yeast, but result in less growth. High gravity starters result in more growth, but are more stressful for the yeast. Exceeding the higher end of the range is stressful on the yeast and should be avoided.

Logsdon says, "Generally, you'd use the lower end of that range [1.020 SG, 5°P] for coming off a plate or slant or very old yeast. Yeast don't get used to a high gravity environment, and the high osmotic pressure can really stress the yeast. Don't forget, you want to increase healthy cells in a starter more than you want to increase the number of unhealthy cells."

Q: When increasing a starter in steps, should the steps be a certain size?

Yes, but there is plenty of leeway in the size of the steps. A "step" is when you take an active starter and increase the volume with more wort. Brewers do this to increase cell mass, while keeping the rate of growth consistent.

The size ratio of one step to the next can affect the health of the yeast and the amount of cell growth. A very large step can result in a change in yeast metabolism, where the sugars that are fermented last can fall out of favor with the yeast. The yeast become lazy and subsequent generations can become lower attenuating.

Making a greater number of small steps increases the chance of contamination. Every transfer, every feeding, every bit of handling you do increases the chance of contamination. Five to ten times the size of the prior step is considered correct. You should try to balance the practical considerations of handling, sanitation, and cell growth.

Q: Don't I need a stir plate to make a starter?

No, you can make a starter without a stir plate. However, a stir plate produces a higher number of cells from the same size starter, and more importantly, it results in better overall cell health.

Logsdon says, "The stir plate causes several things to happen. One is that it drives off the CO2 (which suppresses yeast activity) and allows for an exchange of air into the starter (increasing oxygen levels) and eliminates dead spots in the starter liquid, ensuring that the yeast have easy access to the sugars."

The stirring action keeps the starter oxygenated throughout the entire process, resulting in higher sterol levels and better membrane permeability. However, there are two things to be aware of when using a stir plate. The first is that some stir plates can generate enough heat to push the starter into a temperature range that is detrimental to the yeast. One small stir plate I tested added 5°F (3° C) over the ambient temperature. Using a high quality stir plate or a thin piece of Styrofoam between the flask and the stir plate can help minimize the transfer of heat to the starter. The second thing to be aware of is that the stir plate's action of drawing air into the liquid causes the temperature of the starter to fluctuate quickly with changes in the temperature of the surrounding air. Large temperature fluctuations in the room will result in large fluctuations in the starter temperature and large swings in starter temperature cause less than stellar results.

If you don't have a stir plate, shake the starter as often as you can. It won't be exactly the same as a stir plate, but with regular attention the results can be quite good. In my tests, vigorously shaking a starter every hour resulted in approximately double the number of cells versus a non-shaken starter and a stir plate resulted in a 40% gain over a shaken starter.

Information on making your own inexpensive stir plate can be found on the internet and most advanced homebrew shops sell reasonably priced units.

Q: Can I pitch just a portion of the pack/vial into the same sized starter and get the same amount of cells at the end?

No. You will get more replication from the fewer starting cells, but the end result will not be the same total number of cells. One vial or pack of liquid yeast (at 100 billion cells) into 2 liters of 1.040 wort results in approximately 220 billion cells. According to the Wyeast calculator, 1/10th of a vial or pack results in only 600 million cells. While there is more sugar for each cell to use, you're trying to grow far more cells. You would need to introduce enough additional sugar and nutrients (especially oxygen) to reach the desired cell mass.

If you're trying to grow a lot of yeast from a small amount, grow the yeast in steps to get to the final cell count desired. Keep the starter aerated and provide all of the essential nutrients for the yeast. Pushing yeast to large amounts of cell growth can negatively affect the vitality of the final yeast if they lack enough oxygen produced sterols.

In summary, the products from White Labs and Wyeast are excellent, yet when making a bigger beer or when the yeast has been abused or is old, a clean, properly prepared starter will result in consistent, well fermented beers. Always try to keep your process simple rather than complex and always ask yourself if the beer is the way you like it. If you're making starters, keep track of your process and keep track of the results. In the end, keep the big picture of yeast handling in mind, which is to have healthy yeast first and proper quantities second.