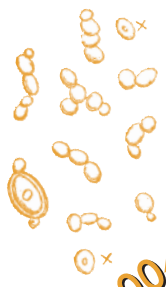
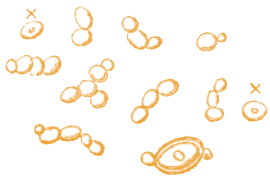
Liquid versus Dried Yeast:

An Old Debate Revisited

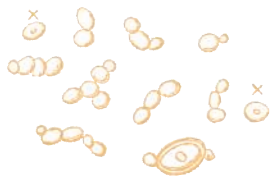
By Horst Dornbusch and Tod Mott



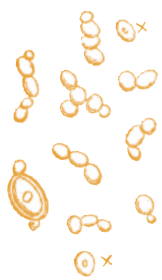


Editor's Note: This article originally appeared in the September/October 2005 issue of The New Brewer.

In 2004, we heard "through the hop vine" that a French yeast maker called S.I. Lesaffre was going to start marketing a selection of dried brewers yeast under the brand name of Fermentis to American craft brewers and eventually to homebrewers as well. *[Note: Fermentis currently has five yeast strains available in 11-gram homebrew-size packets.]*



The promotional campaign is now in full swing with full-page advertisements in major brew magazines. But *dried yeast*? No way! After all, many of us in the American craft brewing industry arrived at the professional ranks via the homebrew route. We remember the bad old days when our dried yeast pitches gave us randomly slow or stuck fermentations at best and infected brews at worst, all for reasons that were largely inexplicable to us then.



In those not too long ago times, we had no choice but to use dried yeast. In fact, the selection in the brew stores was sparse in general. There were perhaps a dozen different cans of extract, a few bags of grain for steeping, a handful of hop varieties (usually of undisclosed alpha-acid content) and two yeast choices—ale and lager, both dried, of mysterious lineage and packed in 7-gram pouches. We made beer with that stuff, and, for an extra kick, we often threw a bag of corn or cane sugar into the brew pot. The beer that emerged from these raw materials was usually drinkable but also unremarkable, at least by today's standards. ➔

Fortunately, when the craft and homebrew revolution gained critical mass, things improved dramatically. By the early 1990s, only the brewer's imagination—and not the range of ingredients—spelled the limits of what could be brewed at home or in a craft brewery. Importantly, brewers gained access to liquid yeast strains—lots of them—and the brew literature was full of articles debating the relative merits of dried versus liquid yeasts. Rightly or wrongly, most of us have since developed a bias in favor of fermenting agents of the liquid kind. Dried stuff, we have all internalized, is just for amateurs and sissies. Real brewers use liquid pitches.

Many of us from the "old school" of dried-yeast skeptics, however, have also learned that liquid yeasts come with their own problems. We are well aware of the difficulties involved in maintaining one or more healthy yeast strains in a brewery, and we have experienced the existential cramps that come with not knowing if the pitch at hand—after three weeks in a keg in the cooler—is still viable. It is against this attitudinal backdrop that we decided to take the "Pepsi challenge," that is, to check for ourselves if the new yeast kid on the block can make beer of commercial quality.

Test Set-Up

S.I. Lesaffre happens to be the largest yeast manufacturer in the world, producing yeast for applications from baking to winemaking to industrial alcohol production. In the United States, the company sells eight commercial varieties of dried brewers yeast—three bottom- and five top-fermenting strains—through its distributor Crosby & Baker of Westport, Mass.

Fermentis' commercial yeasts are shipped sterile in vacuum-packed 500-gram bags, each containing enough yeast for 4 to 6 hectoliters (roughly 3.5 to 5.1 barrels) of wort, depending on the tank temperature at pitching time. Each bag costs about $28, much less than an equivalent amount of liquid yeast. S.I. Lesaffre claims that its dried products are easier to use than liquid yeasts yet produce beers of equal quality. It is these claims of convenience and great taste at a lower price that we set out to test.

We conducted the test at the Portsmouth Brewery, a brewpub in downtown Portsmouth, N.H. on February 17, 2005. We diverted portions of a mildly hopped (17 IBU) cream ale production wort of 12.5 °P (OG 1.050) gravity at a temperature of 58° F (14° C) into four 5-gallon carboys, each pitched with a different yeast, dried and not. To compare the results from dried and liquid yeasts, we selected the same yeast strain, the so-called "Chico" yeast, from three different sources. From White Labs, we used a homebrew-size vial of WLP051 California Ale V liquid yeast. From Wyeast we used a smack-pack of 1056 American Ale liquid yeast. From S.I. Lesaffre we used 12.5 grams (0.44 ounces) of Fermentis US56 Dry Ale yeast.

We started the smack pack the day before brew day. We hydrated the Fermentis yeast in accordance with the producer's instructions for a little more than an hour in 10 times the yeast's weight in sterile wort (in approximately 0.25 liter or 8.5 fluid ounces of wort). Because the three brews had identical specifications (except for the yeast sources) and were being treated identically, we reasoned that any noticeable quantitative or sensory differences should be directly attributable to different Chico strains.

The theoretical assumption, of course, is that there ought to be no sensory differences in the finished beer, because these yeasts are supposed to be genetically identical.

Merely for contrast, we also pitched a 5-gallon carboy of cream ale with a hydrated half-and-half mixture of Fermentis US56 dried ale yeast and Fermentis W-34/70 dried lager yeast. The rest of the wort went into a stainless steel conical fermenter, where it was pitched with the Portsmouth Brewery's house ale yeast, which happens to be White Labs WLP051 California Ale V liquid yeast. We hoped that the hybrid test brew and the regular production batch would give us an additional qualitative and quantitative frame of reference to help us interpret any variations we might discover among the three Chico brews. All batches were pitched simultaneously.

We selected cream ale for the test because its grain bill makes for a fairly neutral brew and the low bittering rate would ensure that the hops did not overpower the rest of the flavors. This, we reasoned, would give us a better chance of detecting sensory variations (if any) that we expected would be present in the beer as a result of the different yeast strains. For the record, we composed the cream ale's 387.5-pound grain bill from 310 pounds (82 percent) of two-row lager malt from Cargill (2.8-3.5 °L); 10 pounds (>2 percent) of caramel malt from Cargill (20 *L); 10 pounds (> 2 percent) of Weyermann Carafoam® malt (1.5-2.4 °L); 7.5 pounds (> 2 percent) of Weyermann acidulated malt (1.7-2.8 °L); and 50 pounds (13 percent) flaked rice from Briess (0.7 °L). We mashed the grist by single infusion at 149° F (65° C). At mash-out, we raised the temperature through sparging to 165° F (74° C). This grain bill yielded a net kettle volume of 224.75 gallons (7.25 barrels) at a color value of 4.4 SRM. We employed a 75-minute boil with additions of Centennial hop pellets for bittering five minutes into the boil, of Ahtanum leaf hops in a steeping bag for flavor 30 minutes into the boil, and Saaz pellets for aroma in the whirlpool.

Test Observations

The White Labs strain had by far the fastest start, showing the first signs of fermentation within 12 hours of pitching. The Wyeast smack-pack took twice as long, 24 hours. The Fermentis Chico batch was in the middle of the two liquid yeasts, starting to crank within 18 hours of pitching time, while the combination of dried ale and lager yeasts kicked in after 16 hours. By day 12, however, all batches were at roughly the same attenuation level, 4.1 °P ± 0.2 °P.

TABLE 1: GRAVITY READINGS OF TEST BREWS

BREW DATE: FEB. 17, 2005; OG: 12.5° P (1.050); SRM: 4.4; IBU: 17

Yeast	WLP 051-V (liquid)	Fermentis US-56 + W-34/70 (dried)	Fermentis US-56 (dried)	Wyeast 1056 (liquid)
Lag time from pitching to start of fermentation	12 hrs	16 hrs	18 hrs	24 hrs
Gravity at day 4	8.0 °P	7.3 °P	7.9 °P	8.4 °P
Day 6	5.0 °P	6.6 °P	5.5 °P	7.5 °P
Day 8	4.9 °P	5.7 °P	4.7 °P	5.9 °P
Day 10	4.6 °P	5.0 °P	4.0 °P	4.9 °P
Day 12	4.0 °P	4.3 °P	3.9 °P	4.2 °P
Day 14	3.4 °P	4.0 °P	3.6 °P	4.0 °P
Day 16	3.1 °P	3.1 °P	3.1 °P	3.9 °P
Day 18	2.9 °P	2.8 °P	2.9 °P	3.7 °P
Day 19	2.4 °P	2.5 °P	2.4 °P	3.5 °P
Day 21 (FG)	2.2 °P	2.2 °P	2.0 °P	3.2 °P
ABV	5.3%	5.3%	5.4%	4.8%

The relatively slow start of the Wyeast batch was clearly an abnormality and was probably attributable to some improper handling of the smack pack before we got it. We have both worked with Wyeast yeasts before and never had such difficulties with lag times. The Wyeast batch remained "behind" the others throughout the trial, but after about four weeks, the finished beer tasted smooth and completely free of defects.

After primary fermentation, there were noticeable differences in the residue collar in the carboy headspace. The two batches fermented with dried yeasts showed the least amount of scum, while the White Labs batch showed the most.

We left the test brews undisturbed in a cool dark corner of the fermentation cellar for a total of three weeks and then racked them into Cornelius kegs. The gravity of the Fermentis dry Chico brew had dropped at that point to 2 °P; the White Labs liquid Chico brew to 2.2 °P; the combination ale-lager brew to 2.2 °P; and the Wyeast liquid Chico brew to 3.2 °P. All test brews and the production batch showed good flocculation and finished equally clear. None of the beers were filtered. Table 1 shows the gravity drops of the test brews.

Sensory Evaluation at End of Fermentation

For us, the big question, after three weeks in the fermenters and before transfer into the conditioning Cornelius kegs, was if there was a noticeable difference in taste between the beers made with dried compared to liquid yeast.

Nose

We found no severe off-aromas in any of the brews' bouquet, just slight variations. The nose of the White Labs batch was slightly fruitier than the others and showed a slight touch of DMS, but no signs of sulfur. The Wyeast batch had perceptible DMS components and a slight vegetal note, probably the effect of the longer lag time between pitching and the start of fermentation. (This would dissipate after conditioning.) The Fermentis ale batch had a few sulfur notes, as did the batch with the dried Fermentis ale and lager yeasts combined, but the latter less so. The Fermentis ale batch had fairly perceptible DMS components, while the combination ale-lager batch was free of DMS. The combination batch also had a slightly "lagerish," green apple, acetaldehyde bouquet.

Up-Front Taste Impression

Though all batches had the same IBU level, there was a noticeable difference in perceived bitterness. The ale-lager combination had the least bitter profile, while the White Labs batch revealed some bitterness. The Wyeast liquid and Fermentis

dried pure ale batches had the most hop character. The parallel production batch gave us a slight sulfur sensation. None of the batches showed any buttery flavors. There were no noticeable levels of diacetyl.

Middle Flavor and Mouthfeel

True to the cream ale style, all four test batches and the production batch turned out light-bodied, with the White Labs batch having the most rounded mouthfeel.

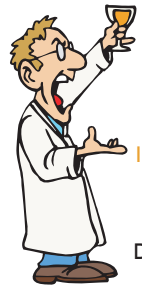
Finish

The three pure ale batches all finished equally dry, while the batch pitched with both ale and lager yeast finished very dry. The Wyeast batch had slightly more hops than malt in the finish, while the White Labs test batch finished clean with a nice balance between maltiness and hop aroma. Interestingly, there was a touch of pleasant sweetness in both the White Labs test and production batches at this stage, but none in the other batches. Both the production and Fermentis ale batches had a slightly viniferous component in the finish, which left a refreshing aftertaste. Finally, the most noticeable component in the finish of the ale-lager combination batch was a touch of hop aroma.

Sensory Evaluation of Conditioned Brews

After two weeks of conditioning the test batches in the cooler at about 38° F (3° C) in Cornelius kegs and the production batch in the unitank at 35° F (2° C) ± 2° F (1° C) at approximately 10 psi, the batches all seemed to converge in nose, taste and finish. There were still a few sensory differences, but they were not as great as at the end of fermentation.

The Wyeast batch especially had made great strides. It was now smooth, rounded and pleasantly balanced. It had a slightly fruity nose, no DMS, no sulfur notes and no off-flavors. It finished with a delicious touch of sweetness and a mild lingering hoppiness. It had slightly more body than the other batches. In our judgment, this brew was late out of the starting gate, but made up ground in the stretch and edged the other batches by a short nose in overall balance. It became a particularly good, hearty cream ale.



Because the three brews had identical specifications (except for the yeast sources) and were being treated identically, we reasoned that any noticeable quantitative or sensory differences should be directly attributable to different Chico strains.

The White Labs test and production batches showed just a touch of sulfur up front, but both finished very clean with a nice balance between gentle tartness and mellow sweetness, which made for a very drinkable cream ale.

The Fermentis pure ale batch showed slightly more bittering hop notes than did the other batches, both up front and in the finish. It also revealed a slight hint of DMS and sulfur, but so faint that these compounds can be detected only by expert palates. There was some residual sweetness in the finish to make the brew reverberate pleasantly on the palate. This ended up being perhaps the most complex and ale-like of the cream ales.

The combination ale-lager batch continued to show true "lagerish" characteristics. The flocculation was perfect, there was no nose and the finish was exceptionally clean and dry, with the Saaz aroma more clearly identifiable in the finish than in the other batches. It was a great and refreshing summer quaffing cream ale.

Conclusion

We set out to prove or disprove a prejudice. We wanted to know if dried yeast can stand up to liquid yeast under controlled conditions. We found that none of the yeasts we tested singularly or in combination were universally better or worse than any others. They all had different strengths and weakness. Obviously, our test, though fair in approach, is only a single experiment and a single data point.

Likewise, our palates, though experienced, are subjective. Our sensory evaluations reflect not only what was in the brews but also what we like and dislike. Our somewhat mixed conclusions, therefore, do not represent law-like generalizations about all characteristics of these yeasts, nor should they be the basis for passing judgment about the relative merits of different yeast brands. That was not our purpose. Rather, we wanted to focus

narrowly on the flavor difference, if any, produced by dried versus liquid yeasts.

We found the White Labs test batch and the two Fermentis batches (ignoring slight notes of sulfur) almost ready to be served to brewpub customers after fermentation, while the Wyeast batch and the original production batch needed more mellowing. After two weeks of conditioning, however, the Wyeast batch had clearly caught up in flavor and mouthfeel. All sulfur notes had largely dissipated, too. Much to our surprise, we liked the hybrid combination test batch of cream ale made with both dried ale and dried lager yeast the best, mostly because it had the cleanest and most appealing flavor from start to finish.

We also observed that, along several variables, the batches with the two liquid yeasts showed greater differences among themselves than they did in comparison with the dried-yeast batches. For example, both the dried Fermentis ale yeast and the liquid Wyeast ale yeasts (in spite of the latter's relatively high final gravity) showed virtually no residual sweetness in the finish, while the liquid White Labs yeast did in both the test and production batches. Likewise, there was no pattern in the lag times of dried and liquid yeasts.

In the end, all our batches resulted in excellent, commercially viable brews. The choice between liquid versus dried yeasts, therefore, should be based on such criteria as brewing objectives, brew house workflows and brewery economics.

Also, because packages of dried yeast have a long shelf life if kept unopened in the refrigerator, they can function as relatively inexpensive backups for situations when the brew schedule becomes unhinged and the yeast harvested from a previous batch has reached a questionable age. The one drawback we see with the current offering of dried yeasts is the relatively limited range of yeast types compared to the huge array of specialty yeasts available in liquid form.

Post-Test Postscript

For us, perhaps the most significant finding from the test was the slightly stronger sulfur component, especially before conditioning, in the batches fermented partially or entirely with dried yeast—a difference that diminished, however, with extended tank times. We decided to verify this conclusion in two production follow-up batches. The first was an all-dried Fermentis yeast cream ale. After fermentation it did indeed show sulfur notes, which, however, ameliorated within two weeks of conditioning. A second hybrid batch of cream ale, fermented with a combination of White Labs liquid ale and Fermentis dried lager yeast, also had a hint of sulfur initially, but tasted clean, "lagerish" and truly delicious after a total of five weeks from brew day.

Tod Mott is the head brewer of the Portsmouth Brewery in New Hampshire. He has won several medals at the Great American Beer Festival, including a 1997 bronze for wheat bock, a 1999 gold for Scotch ale and a 2001 gold for amber ale. Horst Dornbusch is a frequent contributor to several brew magazines. He owns Cerevisia Communications, a PR agency for the international beverage industry. At the 2000 Great American Beer Festival, he won a bronze medal for altbier.