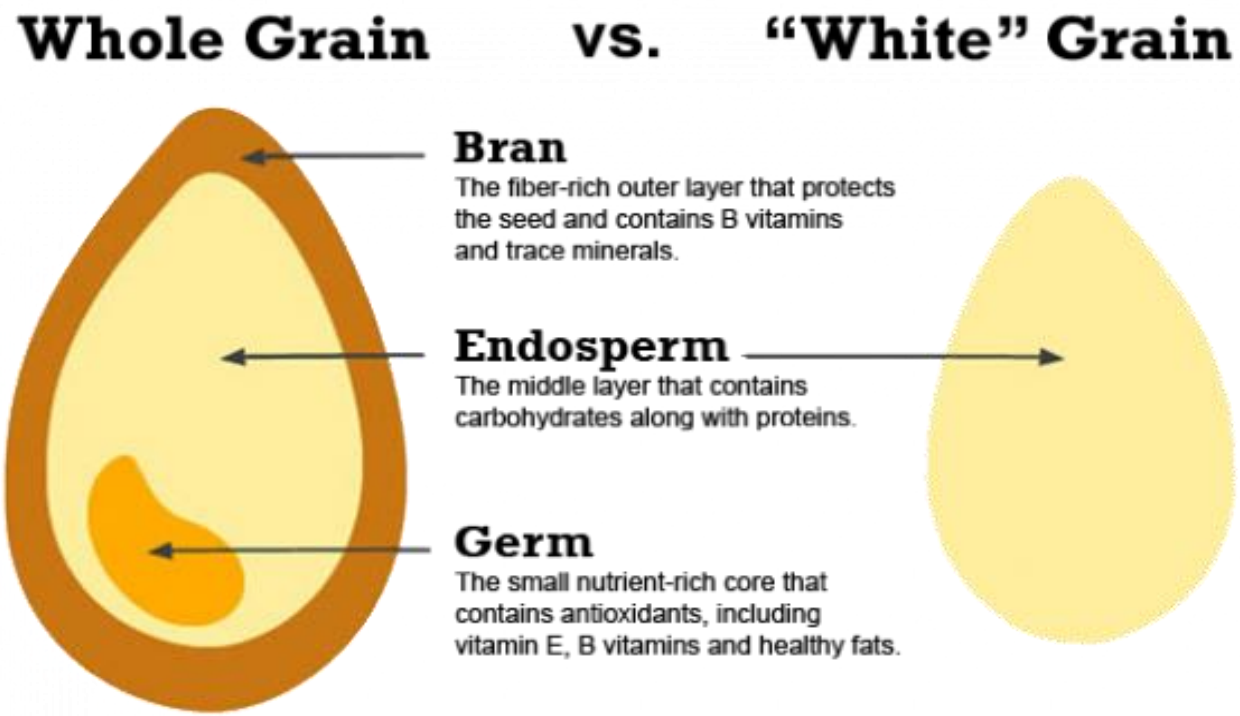
Why Beer is Complicated

As told by a Flavor Chemist and Food Scientist

MY BACKGROUND

- Chemist - started @ Baskin Robbins
- Flavor Chemist - sweetened modifiers
- Food Scientist - grain separations & processing

RICE BRAN



Is Not Rice

Is Not Hulls

RICE BRAN

- Protein
- Carbohydrates
- Fiber
- Bran Oil
  - Mixture of Cool Stuff

WHY BEER

- Extra Hoppy
  - Aroma
  - Taste
- More Bitter

THE JOURNEY

- What I suspected was happening
- What the results were showing
- Why beer hop science is Fu#&ing complicated

WHY DO WE ADD HOPS

- When the 1st addition of hops are added to the boil, the goal is to extract the active humulone components – for simplicity, let's also included all the cohumulon, iso humulone, adhumulone and pre and post humulones.

- As these humulones are extracted and when heated in the boil, they isomerize to form their alpha acids. These alpha acids impart the bitterness that give the beer its wonderful flavor.

- **We are only getting a partial extraction because of the solubility.** Only a portion of the humulon is typically extracted and makes its way into the beer. It is also estimated that 20-30% of the humulones are in the spent hops.

- That means that they never made it out of the spent hops because they simply can't due their poor water solubility. If you could extract more of the humulones, they you would have more alpha acids. More alpha acids means more bittering.

WHAT THE IDEA WAS

- As mentioned, humulone is slightly soluble in in boiling water. What we have found is that by adding a small amount of rice bran mixed in with your boiling hops, you can use the non polar oils that are contained in the rice bran to act as a nonpolar solvent to extract more humulone from your bittering hops.

- Rice Bran contains carbohydrates, protein, fiber and bran oil. The bran oil is a mixture of lecithins, fatty acids, vitamin e, tocopherols etc.

- We can think of this as a non polar solvent

SIMPLE TEST FORMULA

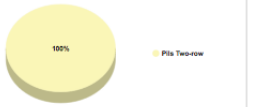
6/28/2016 Recipe Details

Test 101215
Specialty Beer
designed by Rick Ray on 10/13/2015

A Golden, Intensely Bitter, super Hop, American IPA.

VITAL STATS

Style	BJCP 2008 : 23.A Specialty Beer
OG/FG/IBU	1.0494 / 1.0069 / 79
SRM	3
ABV	5.5%
Starting Water	3.55 gal Water
Starting Water Weight	29.63 lbs
Batch Size	2.5 gal



MALTS

Type	Amount (lb)	Gravity (pts)	Color (pts)
Pils Two-row	7 lbs	49.41	2.9

HOPS

Type	Amount (oz)	Alpha Acid %	Time
Cascade	1	7.1	60
Cascade	1	7.1	30

MASH

Type	Temp (F)	Time	Style
Single Step Infusion Mash	152	90	Infusion

BOIL

Type	Temp (F)	Time	Ramp
First Boil	207	60	True

YEAST

Name	Expected AA%	Range Temp (F)	Pitch Temp (F)
Fermentis Safale US-05	86	59 - 71	65

FERMENTATION DIRECTIONS

Normal Ale Fermentation

Cool to 65 F and keep temperature consistent for 10 Days

NOTES

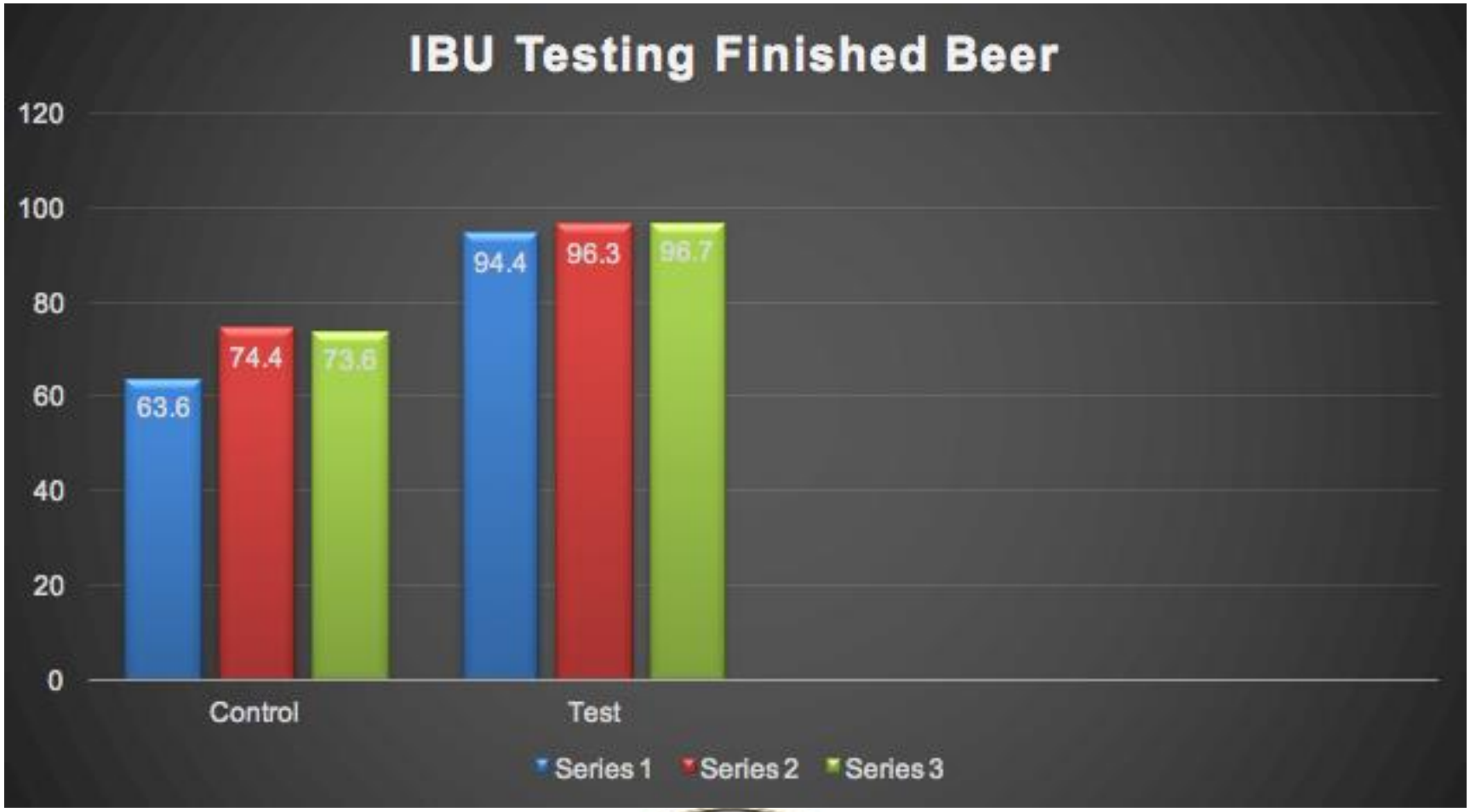
Recipe Notes

Test to try with and without ProRyza Brew in Hop additions for IBU's

https://picobrew.com/Members/Recipes/ParseRecipe.cshtml?id=ba809ffa83ce490e8ff1534c21d6b6 1/2

PICO BREW

NICE INCREASE IN IBU'S -- BUT

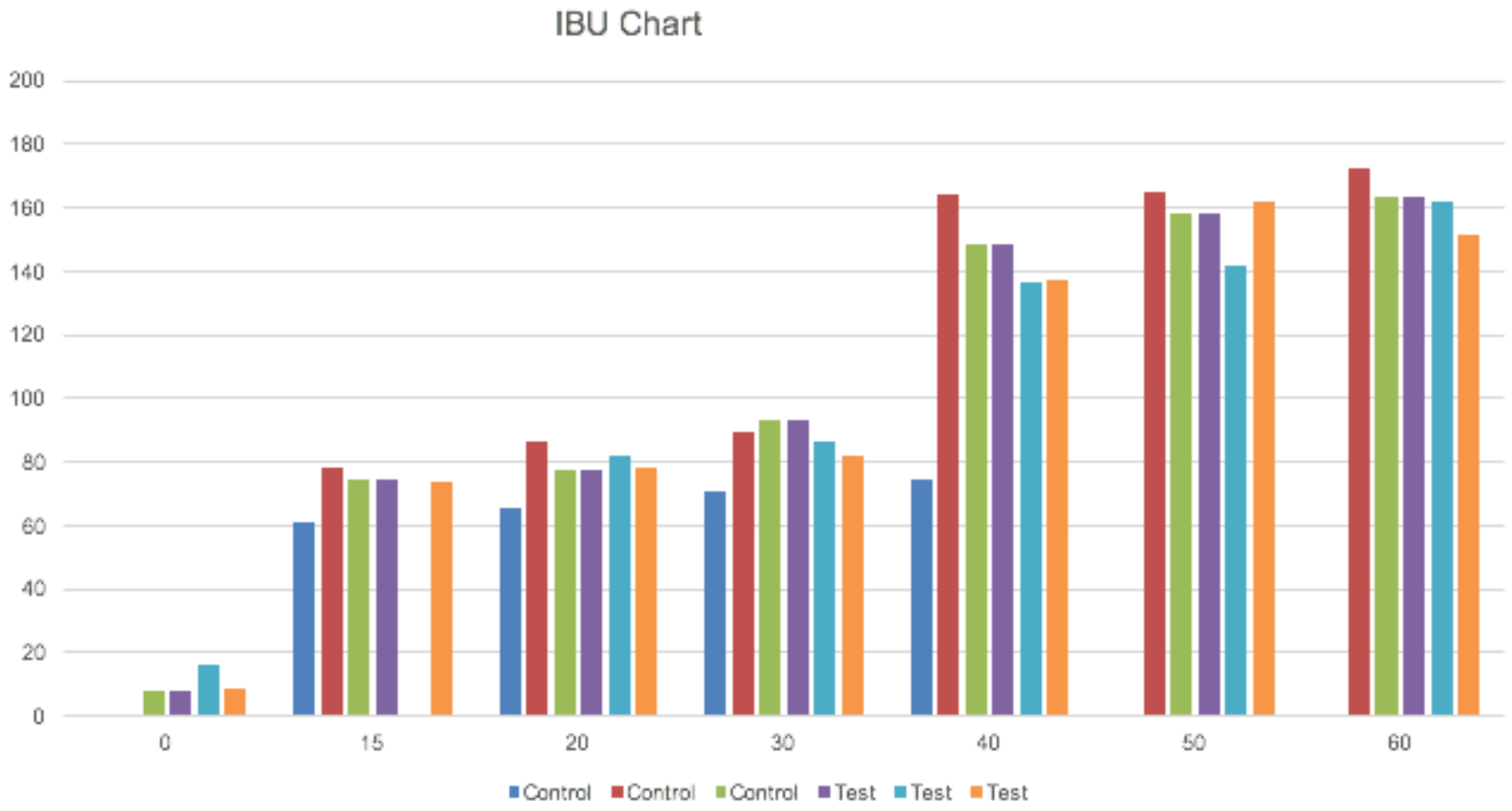


WHY ????

We show a 29% increase in finished beer IBU's

WHY ???

IBU CHART VS BOIL



GRAPH SHOWS LITTLE DIFFERENCE

We expected to see a big jump in IBU's with the test samples.

IBU's were measures using ASBC spectrophotometric analysis

IS IT FERMENTATION

We know that IBU values will drop during fermentation.

Maybe we are changing the surface charges and they yeast will bind less to the alpha acids.

How to check that ??

YEASTS AND ALPHA ACIDS

Yeast cells will grab onto alpha acids during fermentation

Exactly how this occurs is not known. It may have something to do with the electrical charges on iso-alpha acid and beta acids, and the charges of proteins embedded in the yeast cell wall. When the yeast flocculate, they may pull iso-alpha and beta acids with them.

The oils in rice bran act to change the surface charge and keep the yeast from pulling out the alpha acids. This keeps the alpha acids in solution

FLOCCULATION AND SEDIMENT

Control

Test

FERMENTATION NUMBERS

Took wort sample, pitched yeast

Divided into 2 samples

Added Rice Bran into test sample

No difference in measured IBU's
Taste difference :-)

WHY THE TASTE DIFFERENCE

Rice Bran - protein, fiber, carbohydrates, bran oil

Bran Oil is a mix of fatty acids, lecithins, sterols etc

Yeasts will eat fatty acids in anaerobic phase

More activity = more flavor and aroma

How to check that ??

GC/MS

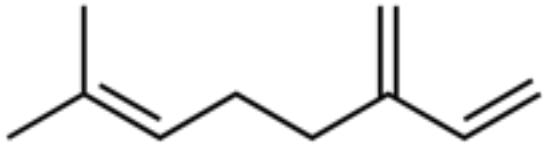
To Be Determined

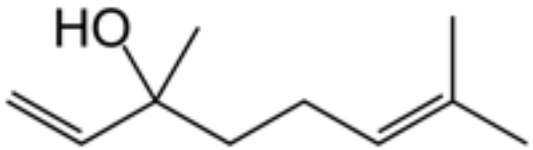
Because typical analysis may not work

2ND ADDITION OF HOPS

Aromatic flavor compounds are oil soluble

Linalool, Myrcene, Terpeniol etc





DRY HOPPING

The aromatic flavor chemicals are oil soluble and you use the ethyl alcohol to act as the non polar solvent to pull out these flavor chemicals and get them back into your beer.

By adding some rice bran you will get additional flavor aromatics because the oil in the rice bran is more non polar. The more non polar, the better the solvent effect.

You do see increased bitterness if left too long.

SUMMARY AND QUESTIONS

The 29% increase in finished beer IBU's does vary with the hops used.

Spectrophotometric vs HPLC show different numbers
Bitterness also comes from polyphenols. Looks like the rice bran is making the bittering polyphenols more water soluble.

Fermentation does seem to be very different, and work needs to be done to better understand the surface tension and the acid/yeast interactions.

THANK YOU

Special thanks to Pico Brew.

Sweet Water Sciences, White Labs, Imperial Organic Yeast and all the brewers who have been kind enough to help answer my crazy questions.

Axiom Foods – rice bran available soon

AXIOM FOODS

MASTER BREWERS ASSOCIATION OF THE AMERICAS ESTD 1887

UNITED WE BREW.