Brewing Bavarian Hefeweizen
Developing a Predictable Approach
by: Harold J. Gulbransen

Why Hefeweizen?
My First Experience with Hefeweizen
A challenging style to brew consistently
Outline of Presentation:

• Beer Style, History, Ingredients & Brewing Process
• Tastings - 5 Batches of Hefeweizen were brewed using different parameters
• Expert Tasting Panel to provide sensory evaluation of the different beers
  o Thanks to Gordon Strong, Ted Hausotter & Jamil Zainasheff
• Discuss: Wheat Malt, POF+ Yeast & Mash profiles
• Conclusions & a reasonable approach to Homebrewing Bavarian Style Hefeweizens
What’s in a Name?

Weizen – wheat, implies wheat beer
Hefeweizen – wheat beer w/ yeast
Weissbier – white beer & wheat beer
Hefeweissbier – wheat beer w/ yeast
Weissbier Hell - pale colored Weizen
Dunkel Weizen – dark wheat beer
Weissbier Dunkel – dark white beer
Weizenbock – wheat beer brewed to Bock strength

[16° P = 1.064 OG]
Bavarian Hefeweizen: a brief history

- 1st Weizens appear at end of 15th century – brewed by Degenbergers - a noble family who have the rights to the style
- Last Degenberger dies in 1602 – brewing rights go to Bavarian House of Dukes
- Duke Maximillian I declared the brewing of Weissbier the exclusive right of the House of Dukes – no public brewing of Weissbier
- Height of popularity was in the 17th & 18th centuries
- Large Weissbier Brewery built on the site of the Hofbrauhaus in Munich
- By 1802 Weissbier had lost it’s popularity and the Brewery was leased to a private brewer
- 1855 Georg Schneider leases the brewery & in 1872 negotiates the release of the brewing rights for Weissbier from the royals
- By 1888 he had moved to a new brewery and tripled production
- The real Renaissance for Weissbier didn’t arrive until well after WW II
Profiles of a Bavarian Hefeweizen

[BJCP guidelines]

Aroma – strong phenols [clove] + fruity esters [banana] in balance, no diacetyl or DMS, low to no hop aroma

Appearance – straw to dark gold in color, moussy, long lasting head, cloudy due to high protein & yeast content

Flavor – banana & clove flavors in balance, soft bready/grainy flavors of wheat, low to no hop flavor & low hop bitterness, no diacetyl or DMS

Mouth feel – med light to med body, creamy

OG: 1.044 – 1.052
FG : 1.010 – 1.014
IBU: 8 – 15
SRM: 2 – 8
ABV: 4.3% - 5.6%

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What Hefeweizens are we sampling today?

- 2 Hefeweizens brewed with a single decoction mash, one fermented at 62° - 63°F & the other at 69° - 70°F
  - Hypothesis = the warmer fermentation will create a less pleasing balance of phenols & esters

- 3 Hefeweizens brewed w/ different mash profiles
  - Single infusion
  - Single decoction w/ a protein rest
  - Single decoction w/ a ferulic acid rest
  - Hypothesis –
    - single infusion will be less interesting, lower phenol & esters profile, thinner mouth feel [longer chain proteins will precipitate out]
    - Protein rest may negatively impact head retention
    - Ferulic acid rest is the classic mash profile
Recipe

8.0 gallons  OG: 1.052  FG: 1.010  11.5 IBU  60 min boil

62.5%  Wheat Malt [Briess]  8.75 lbs
35.7%  Pilsen 2-row Malt [Briess]  5.00 lbs
1.8%  Carastan  34°L  0.25 lbs

50% RO water 50% carbon filtered SD water  1.5 qts water/1 lb grain

Hops:  14 gm  Northern Brewer  9.0% aa  45 min
  14 gm  Hallertau Mittelfruh  3.0% aa  15 min

Mash:  Simplified Single Decoction

Yeast:  White Labs WLP 300 – 1600 cc starter

Fermentation temps:  63°F vs. 70°F

Packaging:  Primed & kegged [to simulate bottle conditioning]
Transferred to clean kegs before transport to Hotel

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For the Decoction:
Remove 1.5 gallons of grain + 1.0 gallons of liquid & grain
Variables that were evaluated

- Fermentation temperatures [63°F vs. 70°F]
- Mash Profiles

Variables that were not evaluated

- Water profiles
- Fermentation vessel geometry
- Yeast strains [WLP 300 only]

Addition experimentation needs to take place on the homebrew scale evaluating fermentation vessel geometry [open vs. closed] & different POF+ [phenol off flavor] yeast strains, as they behave quite differently in different environments and at different temperatures.
Wheat Malt

- <1% of wheat grown in US goes to beer – it is bred for high protein content to form gluten for bread making
- Barley malt - 35% of the protein in Barley is gluten
- Wheat malt – has more protein, more higher molecular weight proteins & 80% of the proteins are gluten !!
- Winter Wheat has less protein than Summer Wheat
Wheat Malt

- Proteins cause:
  - Cloudiness
  - Flavor stability problems
  - Wheat beers must be consumed fresh

- Wheat lacks a husk
  - The aleurone layer is one cell thick
  - More difficult to malt than barley
  - Mash is thicker
  - Lautering problems [maximum 70% wheat malt in a grist]
Hefeweizen Grist

- Must be 50% wheat malt by convention
- Typically 60% - 70% wheat malt
- Pilsner malt + a small % of a Cara malt for color

Yeast need Amino Acids for a healthy fermentation
Wheat beer grists have lower levels of AA’s vs. barley grists

- Mash schedules should include a protein rest where proteolytic enzymes will create adequate levels of AA’s & compensate for low levels of low molecular weight proteins in wheat malt

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Decoction Mashing

- Definition of decoction mashing
- Decoction mashing breaks down high molecular weight proteins for higher levels of AA’s – protein decomposition
- Proper AA levels lead to optimal yeast reproduction & fermentation
- Boiling causes starch molecules to burst making them more accessible to alpha amylase enzymes when returned to the main mash
- Boiling the mash reduces mash pH by precipitating calcium phosphate
- Results in a “cleaner wort” – less trub in kettle as it was left behind in the mush tun
Recipe

8.0 gallons  OG: 1.052  FG: 1.010  11.5 IBU  60 min boil

62.5%  Wheat Malt [Briess]  8.75 lbs
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50% RO water 50% carbon filtered SD water  1.5qts water/1 lb of grain

Hops:  14 gm  Northern Brewer  9.0% aa  45 min
       14 gm  Hallertau Mittelfruh  3.0% aa  15 min

Mash:  Single Infusion at 152°F: Single Decoction w/ a Protein Rest:
       Single Decoction w/ a Ferulic Acid Rest

Yeast:  White Labs WLP 300 – 1600 cc starter

Fermentation temps:  63°F

Packaging:  Primed & kegged  [to simulate bottle conditioning]
Transferred to clean kegs before transport to Hotel

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Single Infusion Mash

Temperature [°F] vs Time [minutes]

- Strike Water
- Grain
- Main Mash
- Sparge

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Single Decoction w/ Protein Rest

Temperature [°F]

Time [minutes]

Strike Water
Grain
Main Mash
Decoction
Sparge

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Brewing a Wheat Beer with Intensive Banana Aroma

A European Perspective
By Michael Eder

Producing a German-style wheat beer may not be as difficult as brewers might think. The most important factors are ingredients and technical knowledge. A little bit of historical background might help, too.

Around 400 years ago during the regency of Lord Maximilian I in Bavaria, wheat beer or "weissbier" was only allowed to be brewed by aristocrats. This type of beer was therefore very desirable for common people. Until then, production and commerce of wheat beer was only done by the aristocratic family Degenberger, who originated from a small town called Bogen in lower Bavaria.

By heritage, the right to produce wheat beer, the so-called "weissbierregal," was passed on to Maximilian I. He foresaw great financial success in producing wheat beer and founded ducal wheat beer brewhouses across the country. The first one was built in 1607 in Kehlheim, a small town on the Danube River. From that time on until the 18th century, wheat beer dominated the Bavarian beer market.

At the turn of the 18th century, tastes began to change and consumers gravitated toward dark or amber beers. Though production declined, the monopoly was still in effect: common people were still not allowed to brew wheat beers.
Single Decoction w/ Ferulic Acid Rest

- Strike Water
- Grain
- Main Mash
- Decoction
- Sparge

Temperature [°F] vs. Time [minutes]

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Hefeweizen Yeasts

- POF+ - “Phenol Off-Flavor” yeast
- In the 1970’s research revealed during fermentation POF+ yeasts convert ferulic acid to 4-vinyl guaiacol [4VG] which gives Weizens their distinctive clove flavor
- Wheat malt has a higher level of ferulic acid & is optimally released during the mash @ 111°F – 113°F at pH 5.7
  - If mash begins at 131°F vs. 111°F – 4VG will be 30% lower

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Hefeweizen Yeasts

- Fermentation below 55°F is sluggish
- Going from 59°F to 68°F will increase 4VG & 4VP [4-vinyl phenol] by 50%
- Going to 77°F will increase 4VG & 4VP by 75%
- POF+ yeasts also produce more fusel alcohols than lager & ale yeasts at higher temps
- Bottle conditioning will increase phenols while reducing any diacetyl
- Weizen Brewers must achieve a balance
Wort Aeration with Oxygen & a SS Aeration Stone
Temperature control during fermentation
Fermentation in a chest freezer with a thermostat
Evaluation of Head Retention

Time = 0

Single Infusion
Single Decoction
Protein Rest
Ferulic Acid Rest
Evaluation of Head Retention
Time = 1 min.
Evaluation of Head Retention
Time = 2 min.
Evaluation of Head Retention
Time = 3 min.

Single Infusion
Single Decoction
Protein Rest
Ferulic Acid Rest
Evaluation of Head Retention
Time = 4 min.
Evaluation of Head Retention
Time = 5 min.

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Evaluation of Head Retention
Time = 6 min.

Single Infusion
Single Decoction
Protein Rest
Ferulic Acid Rest

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Evaluation of Head Retention
Time = 7 min.
Evaluation of Head Retention

- Best to Worst:
  - Single Decoction Mash
  - Protein Rest + Single Decoction
  - Ferulic Acid Rest + Single Decoction
  - Single Infusion Mash
Panel Assessment of the Flavor Profiles

• Single Decoction—smooth & well rounded, the favored Weizen of the Panel

• Protein rest + Single Decoction & Ferulic Acid Rest + Single Decoction – very similar and sharper with more estery and acidic flavors

• Single Infusion – much less flavor and much less interesting

• 70° F fermentation resulted in unpleasant levels of phenols, esters and fusel alcohols
Other Variables to Consider

- **Fermentation Vessel Geometry**
  - Open fermenters create higher phenol levels, allow for skimming of the foam and trub, but less temperature control
  - Cylindro-conical fermenters allow for precise fermentation temperature control

- **Water Chemistry**
  - Quite variable in Bavaria
  - Decoction mashing may make this variable less significant than in other mash schedules where there is no boiling. Boiling the mash precipitates calcium phosphate which lowers the pH without manipulating the water chemistry


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• Jamil Zainasheff
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