

Accounts of Acidity

A Practical Guide to Brewing Berliner Weisse

National Homebrewers Conference 2008

Presented by: Jeff Current



Acknowledgements



Batch Group		Batch Info			Finishing Numbers			Acid Quality	Notes
#	Batch Name	Method	Boil Time	OG/ABV	FG	pH	TA		
Boil Time Experiment									
B1	NB	SYM	NB	1.032	1.006	4.15	0.65%	Nice Mild	Grainy aroma & flavor
B2	15 MIN	SYM	15 MIN	1.032	1.008	4.22	0.60%	Mild Fruit	Oxidation, HSA, Clean Fruit Pear
B3	30 MIN - Dumped	SYM	30 MIN	1.032	-	-	-	Acetic	HSA, acetobactor, acetic acid, Plastic Bucket
B4	60 MIN - Dumped	SYM	60 MIN	1.032	-	-	-	Acetic	HSA, acetobactor, acetic acid, Plastic Bucket
B5	90 MIN - Dumped	SYM	90 MIN	1.032	-	-	-	Acetic	HSA, acetobactor, acetic acid, Plastic Bucket
Yeast Experiment									
Y1	1007	SYM	15 MIN	1.032	1.008	4.34	.5% / 1%	Subtle	Slight Fruitiness, Oxi, 30ml 88% LA = 1.00%TA
Y2	1056	SYM	15 MIN	1.032	1.008	4.25	.5% / 1%	Fruity	Green Grape, Oxidation, Dry Hopped 2oz Santiam, 30ml 88% LA
Y3	1338 - AKA 15 MIN	SYM	15 MIN	1.032	1.008	4.22	0.60%	Mild Fruit	Oxidation, HSA, Clean Fruit Pear
Y4	3068	SYM	15 MIN	1.032	1.010	4.38	0.70%	Strong Mild	Mild Banana & Cherry Pie
Y5	3191 H - Dumped	SYM	15 MIN	1.032	1.004	3.94	-	Brett Sour	68 deg F, Brett Heavy, Slight Lacto, Acetic Aroma, Oxy?
Y6	3191 C - Dumped	SYM	15 MIN	1.032	1.006	4.10	-	Brett Sour	58 deg, Brett Heavy, Slight Lacto, Too Clean not Fruity, Oxy?
Y7	3278	SYM	15MIN	1.028	-	-	-	Lambic Profile	6lbs Raspberries + Raspberry Puree in 2ndary
Method Experiment									
M1	SYM 2M - AKA 1338	SYM	15 MIN	1.032	1.008	4.22	0.60%	Mild Fruit	Oxidation, HSA, Clean Fruit Pear
M2	SYM 4M - AKA PB	SYM	15 MIN	1.032	1.008	3.96	1.00%	Mild Twang	Adjusted w/ 88% LA & Peach Extract @ Kegging
M3	SYM 6M - AKA JB	SYM	15 MIN	1.040	1.011	3.60	1.20%	Citric	Jamil's BW, Mild Brett Infection
M4	SM 5335	SM	15 MIN	1.032	1.010	3.68	0.90%	Twang	Very Slight Acetic Medicinal Tone
M5	SM NADA	SM	15 MIN	1.032	1.010	3.59	1.00%	Twang II	Slight Acetic Medicinal Tone
M6	SW PILS 1 - AKA DHBW	SW	15 MIN	1.032	-	-	-	Clean Acidity	Dave Houseman Sour Wort BW
M7	SW PILS 2 - AKA SB	SW	15 MIN	1.032	1.004	3.60	1.20%	Bright Acid	Cherry type sweetness, clean, grainy
M8	SW PILS 3	SW	15 MIN	1.036	1.020	3.08	1.20%	Tart III	Medicinal Phenol, Twang, Teeth Cleaner
M9	SW ACID	SW	15 MIN	1.052	1.010	3.04	1.65%	Wang	1oz Cascade 15min .25 Amarillo KO, Too Bitter, Medicinal
M10	SW 5335	SW	15 MIN X 2	1.032	1.011	3.06	1.45%	Twangy	Double Boil, Strawberry
M11	SB DECOT 1	SB	15 MIN	1.041	1.011	4.53	0.50%	Not Sour	5335 3WK 1GAL @ 10 days
M12	SB DECOT 2	SB	15 MIN	1.040	1.012	4.31	0.50%	Not Sour	ACIDO @ 10 days
M13	SB HELL 1	SB	15 MIN	1.044	1.020	4.45	0.60%	Not Sour	60 deg F, 5335 1W B
M14	SB HELL 2 - AKA PB2	SB	15 MIN	1.044	1.011	3.81	1.20%	Tart II	68 deg F, 5335 1W A & Peach Puree, 1 Gal 5335 3W, 3oz Peach Extract
Starter Experiment									
S1	NADA	-	15 MIN	1.032	1.030	4.20	0.30%	Slight Funk	Grainy aroma & flavor, 1W 100 deg F, 2W 68 deg F
S2	5335 3WK 1GAL	SB	15 MIN	1.032	1.010	2.90	0.90%	Tart II	Grainy Tart Apple
S3	5335 3WK 5GAL	-	NB	1.032	1.022	2.91	1.30%	Grain Twang	
S4	5335 1WK A	SB	15MIN	1.032	1.019	3.40	0.70%	Sharp I	
S5	5335 1WK B	SB	15MIN	1.032	1.019	3.43	0.65%	Sharp I	
S6	5335 AJ	-	15 MIN	1.032	1.020	3.08	1.40%	Twang III	RRBC 68 deg F 1 Month Very Sour
S7	LACTOSE	-	-	-	-	-	-	-	
S8	YOGURT	-	-	-	-	-	-	-	
S9	ACIDO	SB	15 MIN	1.032	1.010	3.01	1.60%	Sharp III	Dry lacto acidophilus, 20 caps, 1W 100 deg F, 2W 68 deg F

Batch Group		Batch Info			Finishing Numbers			Acid Quality	Notes
#	Batch Name	Method	Boil Time	OG/ABV	FG	pH	TA		
Commercial Examples									
C1	Berliner-Kindl-Schultheiss	-	-	-	-	-	-	-	
C2	Weihenstephan 1809	SYM	NB	5.0%ABV	1.010	3.52	0.65%	Mild	Subtule Banana & Cherry Pie, Brett?
C3	Bayrischer Bahnhof	-	-	3.0%ABV	1.010	3.77	0.70%	Mild	Dry, Good Example of Style
C4	Berliner Burgerbrau	-	-	-	-	-	-	-	
C5	Nodding Head Ich Bin Ein	SYM	15 MIN	1.032	1.008	3.34	0.90%	Very Mild	Have had this beer more sour at brewery
C6	Three Floyds Deesko	-	-	-	-	-	-	-	
C7	DFH Festina Peche	-	-	4.5%ABV	1.006	3.45	1.35%	Sharp III	Extreme Carbonation, Excellent Peach Flavors
C8	New Glarus Unplugged BW	-	-	10 deg P	1.008	3.32	1.40%	Clean	50/50 Wheat/2 Row, 12 IBUs Cascade, 4 Sacch + 3 Brett + Lacto
C9	Southampton BW	SB	15MIN	8.5 deg P	-	-	-	-	Lager Yeast 1st + Sucrose & WLP Lacto delbrueckii 2nd @ 75-80 deg F
C10	JP Calabaza Blanca	-	-	-	1.004	-	0.85%	-	Artisanal White Ale - More a Sour Wit but close to BW
Homebrew Examples									
H1	Snook 3191 A	SYM	15MIN	1.040	1.006	3.54	0.90%	Mild Brett	3191 Brett forward
H3	Eric Menchen	SYM	15MIN	1.030	1.011	3.77	1.20%	Slight Clean	3278 Belgian Lambic Blend, Step Mash
H5	Bryan Evenson	SYM	15MIN	1.032	1.003	4.41	0.90%	Mild	SI, 3191, 63 deg F
H6	Bryan Evenson	SM	15MIN	1.030	1.006	4.33	0.60%	Mild	SI, SM 48 Hours, WLP 011
H7	Patrick Flickinger	SYM	NB	1.035	1.006	4.31	0.90%	Mild	Flaked Wheat, Acid Malt, 1lb CaraHell, Turbid Mash, 3191+ 5335
H8	Ryan Worthington	SYM	NB	1.032	1.003	3.79	1.40%	Wang	3191, Double Decoction, Mash Hop
H12	Jeff Gladish	SYM	60MIN	1.034	1.020	3.71	1.50%	Twang	IBU 10.3, 3191 + 5335
H13	Kris England	SYM	15MIN	14 deg P	1.004	-	-	Sharp III	Mash Hop, Lab Lacto Culture

Berliner History

- 1600's
 - Mentioned in Huguenots text as they crossed Berlin on their way to Flanders
- 1809
 - Napoleon and troops celebrate Prussian victory with it
 - Several Hundred Breweries in Berlin brewed Berliner Weisse
- 2004
 - Radeberger Gruppe combines two major brewers of Berliner Weisse
 - Only handful of Berliner Weisse breweries remain



European Commercial Examples

- Berliner-Kindl-Schultheiss Brauerei
Berliner Kindl
- Bayerische Staatsbrauerei
Weihenstephan
1809 Berliner Style Weisse
- Bayrischer Bahnhof
Berliner Style Weisse
- Berliner Bürgerbräu
Berliner Weisse Himbeer & Waldmeister



American Commercial Examples

- Brewpub Favorites

Nodding Head - Ich Bin Ein

Three Floyds - Deesko

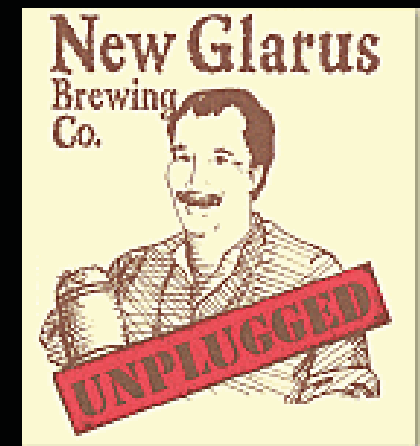


- Seasonal or Special Selections

Southampton - Berliner Weisse

Dogfish Head - Festina Peche

New Glarus - Unplugged Berliner Weisse



Nodding
Head

Berliner Weisse

- Aroma

Sharply Sour, Acidic, Brett Maybe?

- Appearance

Pale straw color, Clear to Hazy

- Flavor

Clean Lactic Sourness
Grainy & Slightly fruity

- Mouthfeel

Light body, very dry finish
Highly Carbonated

“an acidity worthy of Dorothy Parker.”
- Micheal Jackson



Malt Bill

- 30 - 70 % - Continental Pilsner Malt
- 30 - 70 % - Wheat Malt
- 0 - 8 % Acidulated Malt
Lowers Mash Ph
- 0 - 8 % CaraHell / C-10
- 1 - 5 % Rice Hulls - As Lautering Aid
- Target - OG = 1.026 - 1.036 & SRM = 2 - 4



Hopping your Berliner

- German Noble or Derivatives

Hallertau

Magnum

Tettnanger

Santiam

Saaz

Sterling

- Low Bittering ~ 4 IBUs

- Mash/Liquor Hopping

- Boil Hopping

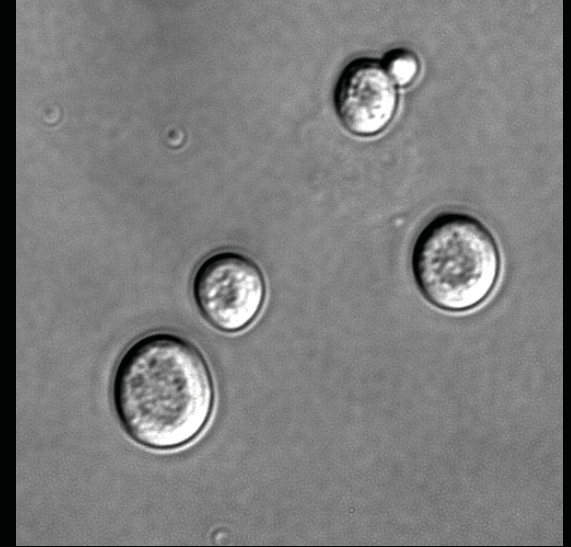
- Hopping Post Lactic

Latobacillus don't like hops



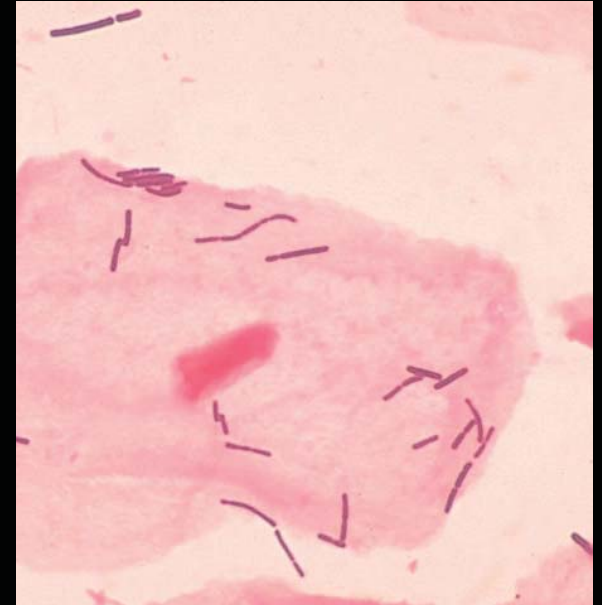
Saccharomyces cerevisiae

- Clean Neutral Ale Yeast
California Ale Yeast
- Slightly Fruity Ale Yeasts
European Ale Yeast
German Ale Yeast
- Blending Yeasts
- Kolsch - not appropriate / too much sulfur
- Weihenstephan Weizen - maybe / maybe not



Lactobacillus delbrueckii

- Clean Lactic Sourness
- Sources
 - Grain
 - Pure Culture - Liquid / Dry
 - 88% Lactic Acid Spike - not the same
- Grows best at or above 85 deg F
- Wort Aeration / CO₂ / Pressure
- Target 0.5% - 1.5% Lactic Acid - Titration Test



brettanomyces / pediococcus

- *lactobacillus* - should dominate flavor profile
- *brettanomyces*
 - Played a role in some original Berlin Weisse beers
 - Doesn't appear in most American versions
- *pediococcus*
 - plays a larger of a role in Lambic
 - Doesn't appear in Berliner Wiese - too much diacetyl
- *Wyeast 3191 VVS* - Berliner Weisse Blend
- *Lambic & Sour Ale Yeast Blends*
 - not right flavor profile
 - too much brett, not enough lacto

Among Friends

Landscape of sour ales

Lactobacillus
Pediococcus

Lactic acid

ethyl lactate

Brettanomyces
4-ethyl phenol

4-ethyl guaiacol

Petrus
OAK AGED
DARK BEER

Ciepmans

3 Fonteinen
BROUWERIJ
KRIEK
VAN SCHAERBEEKSE KRIEKEN

BIERE DE MARS
ALE

Reinaert
Wild ale

CANTILLON
Gueuze 100% Lambic Bio

La Folie
Wild ale

Orval

GUINNESS

ethyl acetate

acetic acid

Ethanol

Saccharomyces

VERHAEGHE

Acetobacter
Enterobacteriaceae
copyright Raj B Apte, 2004

Cleaning & Sanitation

- Take Additional Care in Sanitation

“Twice and Double...” - Gordon Grubb

Additional Heat in Cleaning Water

Clean Twice

Sanitize Longer

- Separate Plastics from “Clean Beers”

“Have two of everything.” - Vinnie Cilurzo

Hoses, Buckets, & Gaskets

- Glass & Stainless

Should be OK with Cleaning & Sanitation

Conditioning & Carbonation

- Krauesening & Redosing Lacto
- Warm Conditioning
Promotes development of lacto
- Cold Conditioning
Promotes clarification
- Carbonation
3.5 - 4 Volumes of CO₂
- Bottle in Thick Bottles



Glassware, Syrup, & Straws

- Large Wide Mouth Goblet or Bowl
- Syrups - Added at Packaging or Serving
 - Himbeer - Raspberry
 - Waldminster - Woodruff
 - 10% off at www.germandeli.com
 - on orders over \$25 w/ Code: BEERTOWN
- Drinking beer through a straw?
 - Alcopop



Berliner Brewing Methods

- Single Infusion - 15 min Boil
American Brewpub
- Step & Decoction Mashing - No Boil
Traditional
- Sour Mash - 15 min Boil
- Sour Wort - 15 min Boil / Double Boil
- Split Batch

Lactic Fermentation

- Symbiotic - *Saccharomyces & lactobacillus*
Temperatures - 64 - 68 deg F
- Split Batch / Lacto Starter
Saccharomyces - 58 - 64 deg F
lactobacillus - 85 - 100 deg F
- Sour Wort / Mash
lactobacillus - 80 - 120 deg F
Saccharomyces - 58 - 64 deg F

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Boil Time Experiment									
B1	NB	SYM	NB	1.032	1.006	4.15	0.65%	Nice Mild	Grainy aroma & flavor
B2	15 MIN	SYM	15 MIN	1.032	1.008	4.22	0.60%	Mild Fruit	Oxidation, HSA, Clean Fruit Pear
B3	30 MIN - Dumped	SYM	30 MIN	1.032	-	-	-	Acetic	HSA, acetobactor, acetic acid, Plastic Bucket
B4	60 MIN - Dumped	SYM	60 MIN	1.032	-	-	-	Acetic	HSA, acetobactor, acetic acid, Plastic Bucket
B5	90 MIN - Dumped	SYM	90 MIN	1.032	-	-	-	Acetic	HSA, acetobactor, acetic acid, Plastic Bucket
Yeast Experiment									
Y1	1007	SYM	15 MIN	1.032	1.008	4.34	.5% / 1%	Subtle	Slight Fruitiness, Oxi, 30ml 88% LA = 1.00%TA
Y2	1056	SYM	15 MIN	1.032	1.008	4.25	.5% / 1%	Fruity	Green Grape, Oxidation, Dry Hopped 2oz Santiam, 30ml 88% LA
Y3	1338 - AKA 15 MIN	SYM	15 MIN	1.032	1.008	4.22	0.60%	Mild Fruit	Oxidation, HSA, Clean Fruit Pear
Y4	3068	SYM	15 MIN	1.032	1.010	4.38	0.70%	Strong Mild	Mild Banana & Cherry Pie
Y5	3191 H - Dumped	SYM	15 MIN	1.032	1.004	3.94	-	Brett Sour	68 deg F, Brett Heavy, Slight Lacto, Acetic Aroma, Oxy?
Y6	3191 C - Dumped	SYM	15 MIN	1.032	1.006	4.10	-	Brett Sour	58 deg, Brett Heavy, Slight Lacto, Too Clean not Fruity, Oxy?
Y7	3278	SYM	15MIN	1.028	-	-	-	Lambic Profile	6lbs Raspberries + Raspberry Puree in 2ndary
Method Experiment									
M1	SYM 2M - AKA 1338	SYM	15 MIN	1.032	1.008	4.22	0.60%	Mild Fruit	Oxidation, HSA, Clean Fruit Pear
M2	SYM 4M - AKA PB	SYM	15 MIN	1.032	1.008	3.96	1.00%	Mild Twang	Adjusted w/ 88% LA & Peach Extract @ Kegging
M3	SYM 6M - AKA JB	SYM	15 MIN	1.040	1.011	3.60	1.20%	Citric	Jamil's BW, Mild Brett Infection
M4	SM 5335	SM	15 MIN	1.032	1.010	3.68	0.90%	Twang	Very Slight Acetic Medicinal Tone
M5	SM NADA	SM	15 MIN	1.032	1.010	3.59	1.00%	Twang II	Slight Acetic Medicinal Tone
M6	SW PILS 1 - AKA DHBW	SW	15 MIN	1.032	-	-	-	Clean Acidity	Dave Houseman Sour Wort BW
M7	SW PILS 2 - AKA SB	SW	15 MIN	1.032	1.004	3.60	1.20%	Bright Acid	Cherry type sweetness, clean, grainy
M8	SW PILS 3	SW	15 MIN	1.036	1.020	3.08	1.20%	Tart III	Medicinal Phenol, Twang, Teeth Cleaner
M9	SW ACID	SW	15 MIN	1.052	1.010	3.04	1.65%	Wang	1oz Cascade 15min .25 Amarillo KO, Too Bitter, Medicinal
M10	SW 5335	SW	15 MIN X 2	1.032	1.011	3.06	1.45%	Twangy	Double Boil, Strawberry
M11	SB DECOT 1	SB	15 MIN	1.041	1.011	4.53	0.50%	Not Sour	5335 3WK 1GAL @ 10 days
M12	SB DECOT 2	SB	15 MIN	1.040	1.012	4.31	0.50%	Not Sour	ACIDO @ 10 days
M13	SB HELL 1	SB	15 MIN	1.044	1.020	4.45	0.60%	Not Sour	60 deg F, 5335 1W B
M14	SB HELL 2 - AKA PB2	SB	15 MIN	1.044	1.011	3.81	1.20%	Tart II	68 deg F, 5335 1W A & Peach Puree, 1 Gal 5335 3W, 3oz Peach Extract
Starter Experiment									
S1	NADA	-	15 MIN	1.032	1.030	4.20	0.30%	Slight Funk	Grainy aroma & flavor, 1W 100 deg F, 2W 68 deg F
S2	5335 3WK 1GAL	SB	15 MIN	1.032	1.010	2.90	0.90%	Tart II	Grainy Tart Apple
S3	5335 3WK 5GAL	-	NB	1.032	1.022	2.91	1.30%	Grain Twang	
S4	5335 1WK A	SB	15MIN	1.032	1.019	3.40	0.70%	Sharp I	
S5	5335 1WK B	SB	15MIN	1.032	1.019	3.43	0.65%	Sharp I	
S6	5335 AJ	-	15 MIN	1.032	1.020	3.08	1.40%	Twang III	RRBC 68 deg F 1 Month Very Sour
S7	LACTOSE	-	-	-	-	-	-	-	
S8	YOGURT	-	-	-	-	-	-	-	
S9	ACIDO	SB	15 MIN	1.032	1.010	3.01	1.60%	Sharp III	Dry lacto acidophilus, 20 caps, 1W 100 deg F, 2W 68 deg F

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C3	Bayrischer Bahnhof	-	-	3.0%ABV	1.010	3.77	0.70%	Mild	Dry, Good Example of Style
C4	Berliner Burgerbrau	-	-	-	-	-	-	-	
C5	Nodding Head Ich Bin Ein	SYM	15 MIN	1.032	1.008	3.34	0.90%	Very Mild	Have had this beer more sour at brewery
C6	Three Floyds Deesko	-	-	-	-	-	-	-	
C7	DFH Festina Peche	-	-	4.5%ABV	1.006	3.45	1.35%	Sharp III	Extreme Carbonation, Excellent Peach Flavors
C8	New Glarus Unplugged BW	-	-	10 deg P	1.008	3.32	1.40%	Clean	50/50 Wheat/2 Row, 12 IBUs Cascade, 4 Sacch + 3 Brett + Lacto
C9	Southampton BW	SB	15MIN	8.5 deg P	-	-	-	-	Lager Yeast 1st + Sucrose & WLP Lacto delbrueckii 2nd @ 75-80 deg F
C10	JP Calabaza Blanca	-	-	-	1.004	-	0.85%	-	Artisanal White Ale - More a Sour Wit but close to BW
Homebrew Examples									
H1	Snook 3191 A	SYM	15MIN	1.040	1.006	3.54	0.90%	Mild Brett	3191 Brett forward
H3	Eric Menchen	SYM	15MIN	1.030	1.011	3.77	1.20%	Slight Clean	3278 Belgian Lambic Blend, Step Mash
H5	Bryan Evenson	SYM	15MIN	1.032	1.003	4.41	0.90%	Mild	SI, 3191, 63 deg F
H6	Bryan Evenson	SM	15MIN	1.030	1.006	4.33	0.60%	Mild	SI, SM 48 Hours, WLP 011
H7	Patrick Flickinger	SYM	NB	1.035	1.006	4.31	0.90%	Mild	Flaked Wheat, Acid Malt, 1lb CaraHell, Turbid Mash, 3191+ 5335
H8	Ryan Worthington	SYM	NB	1.032	1.003	3.79	1.40%	Wang	3191, Double Decoction, Mash Hop
H12	Jeff Gladish	SYM	60MIN	1.034	1.020	3.71	1.50%	Twang	IBU 10.3, 3191 + 5335
H13	Kris England	SYM	15MIN	14 deg P	1.004	-	-	Sharp III	Mash Hop, Lab Lacto Culture

Recipes - Ich Bin Ein Berliner Weisse Clone - Symbiotic

Bronze Medal GABF 2004
Recipe by Gordon Grubb
Nodding Head Brewery & Restaurant, Philadelphia

Ingredients:

70% Pilsner Malt
30% Wheat Malt
4 IBUs Hallertau at 15 min

1007 German Ale
Wyeast 5335 Lactobacillus

Original Target Gravity: 1.030
Final Target Gravity: 1.007
ABV: 3.3
IBU: 4

Directions:

Mash at 150 deg F (66 deg C) for 60 min.
Sparge with 170 deg F water.
Boil wort for 15 min adding hops at beginning of boil.
Cool and pitch yeast and bacteria in primary.
Ferment at 66 deg F 5-6 weeks until final gravity and desired sourness has been achieved.
Re-pitch yeast and bacteria in subsequent batches to obtain ultimate levels of sourness desired.

Recipes - Pucker Peach - Sour Wort

Ingredients:

60% Pilsner Malt
40% Wheat Malt
Rice Hulls as lautering aid
4 IBUs Hallertau at 15 min

Original Target Gravity: 1.042
Final Target Gravity: 1.010
ABV: 4.2
IBU: 4

Wyeast 1338 European Ale

Peach Puree and/or Peach Extract

Directions:

Mash at 149 deg F (66 deg C) for 90 min.
Recirculate with 170 deg F water to bring mash up to 168 deg F.
Sparge with 170 deg F water.
Collect wort and keg with 1 lb or Pilsner or Acidulated Malt per 5 gallons.
Hold wort between 120 deg F - 85 deg F for 24-36 hours.
Release CO2 pressure and check acid content by titration test every 12 - 24 hours.
Target TA between .5% - 1%
Rack wort to kettle slowly under CO₂ pressure.
Boil wort for 15 min adding hops at beginning of boil.
Cool and pitch yeast in primary.
Ferment at 66 deg F 5-6 weeks until final gravity has been achieved.
Rack to secondary and add fruit for two weeks.
Rack to keg or bottling bucket and adjust fruit aroma with extract.

Recipes - Weiße mit Schuss Wanzenplage - Split Batch

Ingredients:

45% Pilsner Malt
55% Wheat Malt
5% Acidulated Malt
5% CaraHell
Rice Hulls as lautering aid
4 IBUs Hallertau Mash Hops

Original Target Gravity: 1.032
Final Target Gravity: 1.004
ABV: 3.3
IBU: 4

Wyeast 1007 German Ale
Wyeast 5335 Lactobacillus

Directions:

Mash in at 122 deg F (66 deg C) for 30 min.

Raise temp to 133 deg F for 15 min.

Raise temp to 149 deg F for 60 min. Add whole hops to mash.

Recirculate with 170 deg F water to bring mash up to 168 deg F.

Sparge with 170 deg F water.

Divide wort into two vessels 2/3rds - 1/3rd.

Aerate and cool 2/3rds of wort to 66 deg F then pitch *Sacchomyces*. Ferment at 58 - 64 deg F.

Cool 1/3rd of wort to 90 deg F and pitch *Lactobacillus* bacteria, don't aerate.

Hold bacteria under CO₂ pressure @ 80 - 90 deg F for 24 - 36 hours until TA = .5% - 1.5% and pH = 3 - 3.5.

Add bacteria beer to fermenting beer near the end of fermentation and raise temperate to 66 - 68 deg F.

Allow fermentation to finish until a Final Target Gravity of 1.004 has been achieved.

Condition at 33 deg F for 2 - 4 weeks.

Bottle of force carbonate to 4 volumes of CO₂.

Recipes - Funky Bucket - Sour Mash

Ingredients:

60% Pilsner Malt
40% Wheat Malt
Rice Hulls as lautering aid
4 IBUs Hallertau at 15 min

Original Target Gravity: 1.032
Final Target Gravity: 1.004
ABV: 3.3
IBU: 4

Wyeast 1338 European Ale
Wyeast 5335 Lactobacillus - optional

Directions:

Mash at 150 deg F (66 deg C) for 60 min.
Allow mash temp to drop to 120 deg F and hold above 80 deg F for 24 - 36 hours.
Recirculate with 170 deg F water to bring mash up to 168 deg F.
Sparge with 170 deg F water.
Boil wort for 15 min adding hops at beginning of boil.
Cool and pitch yeast and bacteria in primary.
Ferment at 66 deg F 5-6 weeks until final gravity and desired sourness has been achieved.