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Brewtubers 2020 Yeast Experiment

Brewtubers.com/yeastexpresults

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How does yeast affect a basic West Coast IPA

Does the yeast change aroma and flavor profiles in beer with late kettle and whirlpool hops

Experiment Overview

- As an online home brewers club we wanted to conduct and experiment on the affects of yeasts on a basic West Coast IPA recipe, with well known hops; Centennial (bitter 2 charge), Citra (whirlpool), and Simcoe (dry Hop).
- Our challenge was to reduce the wort variables as much as possible. This dictated that we all begin with Distilled or RO water, TDS < .09 and a neutral water profile using Calcium 60 ppm Mag 0, sodium 0, chloride 64, sulfate 59, ratio 1.08 desired PH 5.3 . PH was achieved through acid malt.
- Further reduction of variables was to also adjust Hop AA based on individual hops. (future experiments we will try to send hops in advance from the same farm, and crop year).

Experiment Overview (continued)

- All brewers were to shoot for a 1.066 O.G. with a similar boil off rate. With 12 different brewers and 13 participants (2 brewers brewed together on 1 system and split a batch). All brewers came to within +/-.002 O.G., outliers of 1.062 x2.
- We all selected a different yeast and fermented with temperature regulation per yeast manufacturers recommended ranges, the temperatures were noted on the samples. (pressure fermentation was not allowed)
- All beers were shipped to a hub coordinator who intern repacked 12 boxes with 12 different beers in each so each participant could review 12 different iterations (13) including their own.

Experiment Overview (continued)

- These beers were reviewed on camera and graded on their aroma, flavor, mouthfeel, general impression of the beer. Caveat: The scoring of these beers were not an endorsement of the best yeast on the market rather what was the best yeast for this recipe and hop selection.
- We did a minimum of a 3 day cold crash without any post fermentation clarifying agents. The final 24 hours was a Simcoe dry hop to eliminate the possible bio transformation of dry hop additions.
- Known minor BH variables were minimized as most brewers use a similar brew system for wort production. Although we acknowledge that BH variables do not make this a scientific study, the results were quite surprising none the less.

Experiment goals

- What influences does yeast have on a standard mild West Coast IPA?
- Do late kettle hops and whirlpool hops become bio transformed in the final beer?
- Do yeasts higher in Beta-Glucosidase transform late hop Kettle and whirlpool additions by altering the non aromatic glycosides into aromatic linalool citronellol?
- Eliminate possible yeast biotransformation of dry hopping additions by cold 24 hour dry hop additions prior to a closed transfer to corny keg.
- Try to identify the best yeast for this style of beer with well known hops.

Variables

Controlled variables	Independent variable	Dependent variable
• Water, Grist, Hops AA, O.G.	• Yeast • Brew house	• Known Yeast character • Yeast Hop Biotransformation

The Recipe

Yeast Experiment IPA

American IPA (21 A)

Type: All Grain
Batch Size: 5.00 gal
Boil Size: 6.73 gal
Boil Time: 60 min
End of Boil Vol: 5.73 gal
Final Bottling Vol: 4.50 gal
Fermentation: Ale, Two Stage
Taste Notes:

Date: 05 Dec 2019
Brewer: Brewtubers
Asst Brewer:
Equipment: HERIMS 6.5
Efficiency: 68.00 %
Est Mash Efficiency: 74.8 %
Taste Rating: 30.0

Ingredients

Amt	Name	Type	#	%/IBU
12 lbs	Pale Malt (2 Row) US (2.0 SRM)	Grain	1	88.2 %
8.0 oz	Caramel/Crystal Malt - 40L (40.0 SRM)	Grain	2	3.7 %
8.0 oz	Honey Malt (25.0 SRM)	Grain	3	3.7 %
5.6 oz	Acid Malt (3.0 SRM)	Grain	4	2.6 %
4.0 oz	Cara-Pils/Dextrine (2.0 SRM)	Grain	5	1.8 %
0.50 oz	Centennial [11.00 %] - Boil 45.0 min	Hop	6	17.5 IBUs
0.75 oz	Centennial [11.00 %] - Boil 30.0 min	Hop	7	23.1 IBUs
0.25 tsp	Irish Moss (Boil 10.0 mins)	Fining	8	-
2.00 oz	Citra [12.00 %] - Steep/Whirlpool 20.0 min	Hop	9	24.1 IBUs
2.00 oz	Simcoe [13.00 %] - Dry Hop 1.0 Days	Hop	10	0.0 IBUs

Gravity, Alcohol Content and Color

Est Original Gravity: 1.066 SG
Est Final Gravity: 1.017 SG
Estimated Alcohol by Vol: 6.5 %
Bitterness: 64.7 IBUs
Est Color: 7.5 SRM

Measured Original Gravity: 1.068 SG
Measured Final Gravity: 1.010 SG
Actual Alcohol by Vol: 7.7 %
Calories: 227.9 kcal/12oz

Mash Profile

Mash Name: Single Infusion, Medium Body, No Mash Out
Sparge Water: 3.12 gal
Sparge Temperature: 168.0 F
Adjust Temp for Equipment: TRUE
Est Mash PH: 5.67
Measured Mash PH: 5.20

Total Grain Weight: 13 lbs 8.8 oz
Grain Temperature: 72.0 F
Tun Temperature: 72.0 F
Target Mash PH: 5.20
Mash Acid Addition:
Sparge Acid Addition:

Mash Steps

Name	Description	Step Temperature	Step Time
Mash In	Add 23.94 qt of water at 169.6 F	152.0 F	60 min

Sparge: Fly sparge with 3.12 gal water at 168.0 F

Mash Notes: Simple single infusion mash for use with most modern well modified grains (about 95% of the time).

Carbonation and Storage

Carbonation Type: Bottle
Pressure/Weight: 3.53 oz
Keg/Bottling Temperature: 70.0 F

Volumes of CO2: 2.3
Carbonation Est: Bottle with 3.53 oz Corn Sugar
Carbonation (from Meas Vol): Bottle with 3.93 oz Corn Sugar

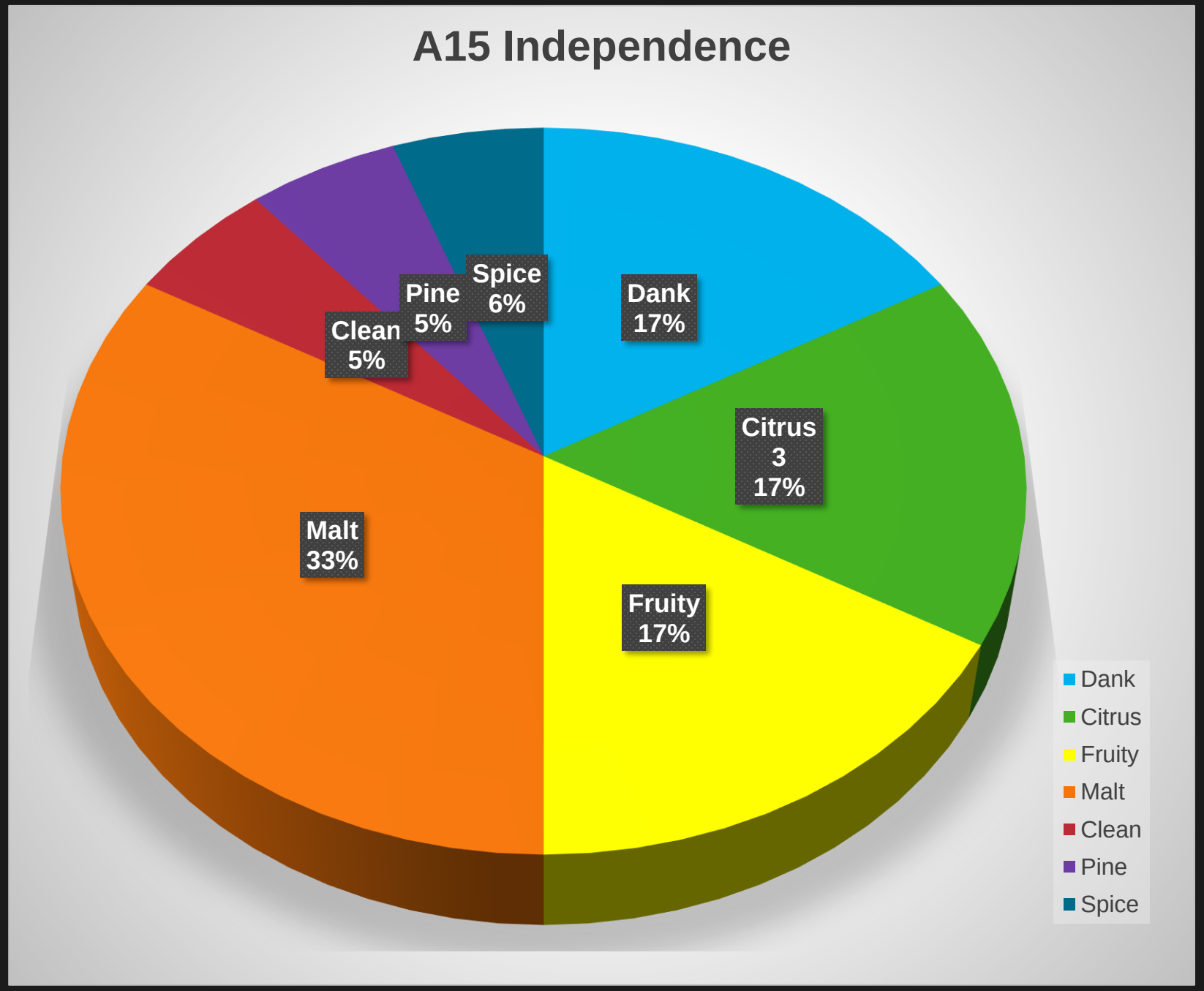
Data/Observations

Imperial A15 Independence received an overall score of 10.5 out a possible 13.

This yeast scored the highest via overall average, not a statistical average.

The pie chart to the right is the Aroma/flavor profile that the yeast theatrically Imposed or left neutral on late hop kettle additions, as well as some yeast esters.

Final Note all beers reviewed approximately a month after Packaging.



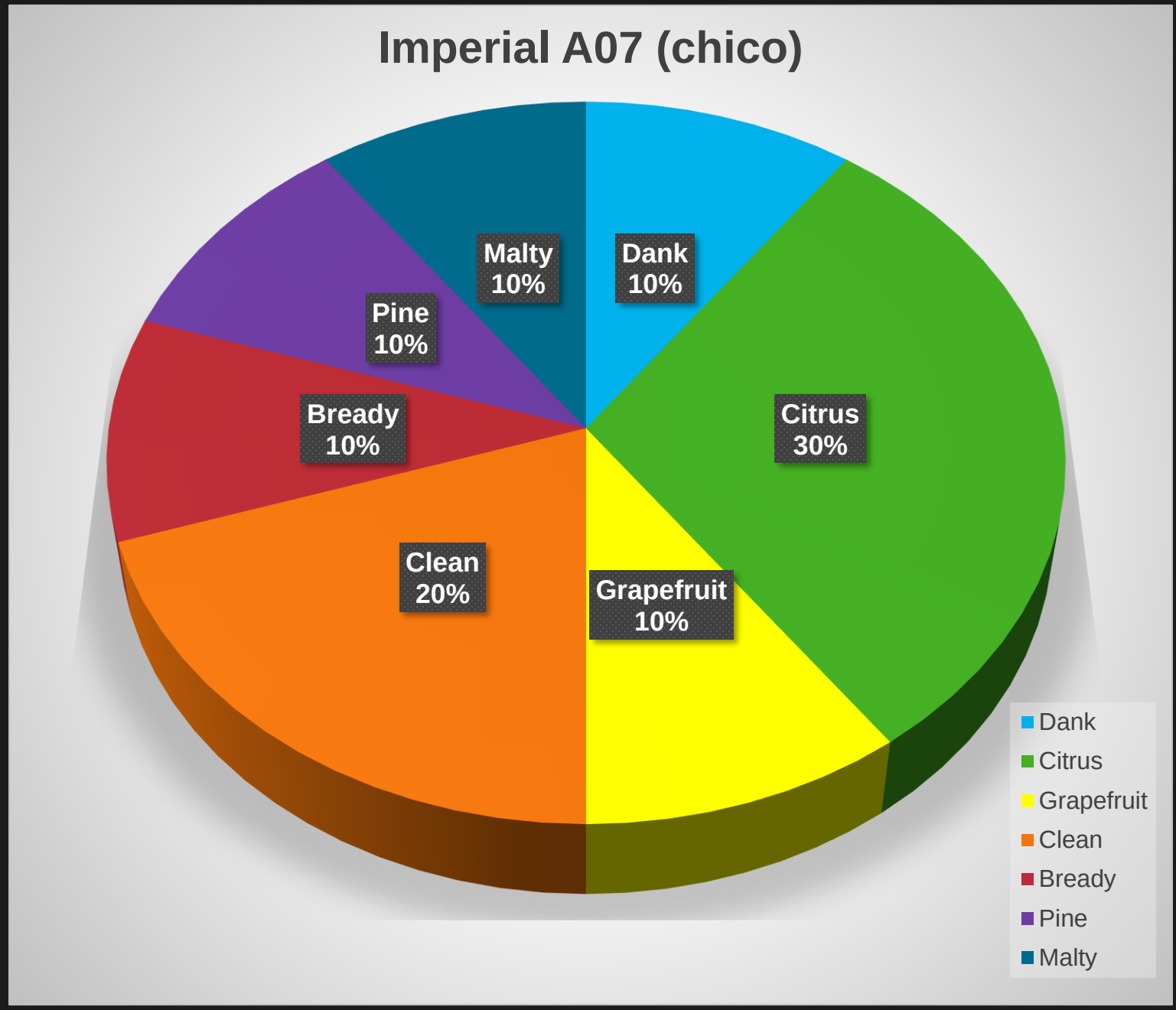
Data/Observations

Imperial A07 (Chico)
received an overall score of 9.1 out a possible 13.

This was the next highest score via overall average, not a statistical average.

The pie chart to the right is the Aroma/flavor profile that the yeast theatrically Imposed or left neutral on late hop kettle additions, as well as some yeast esters.

Final Note all beers reviewed approximately a month after Packaging.



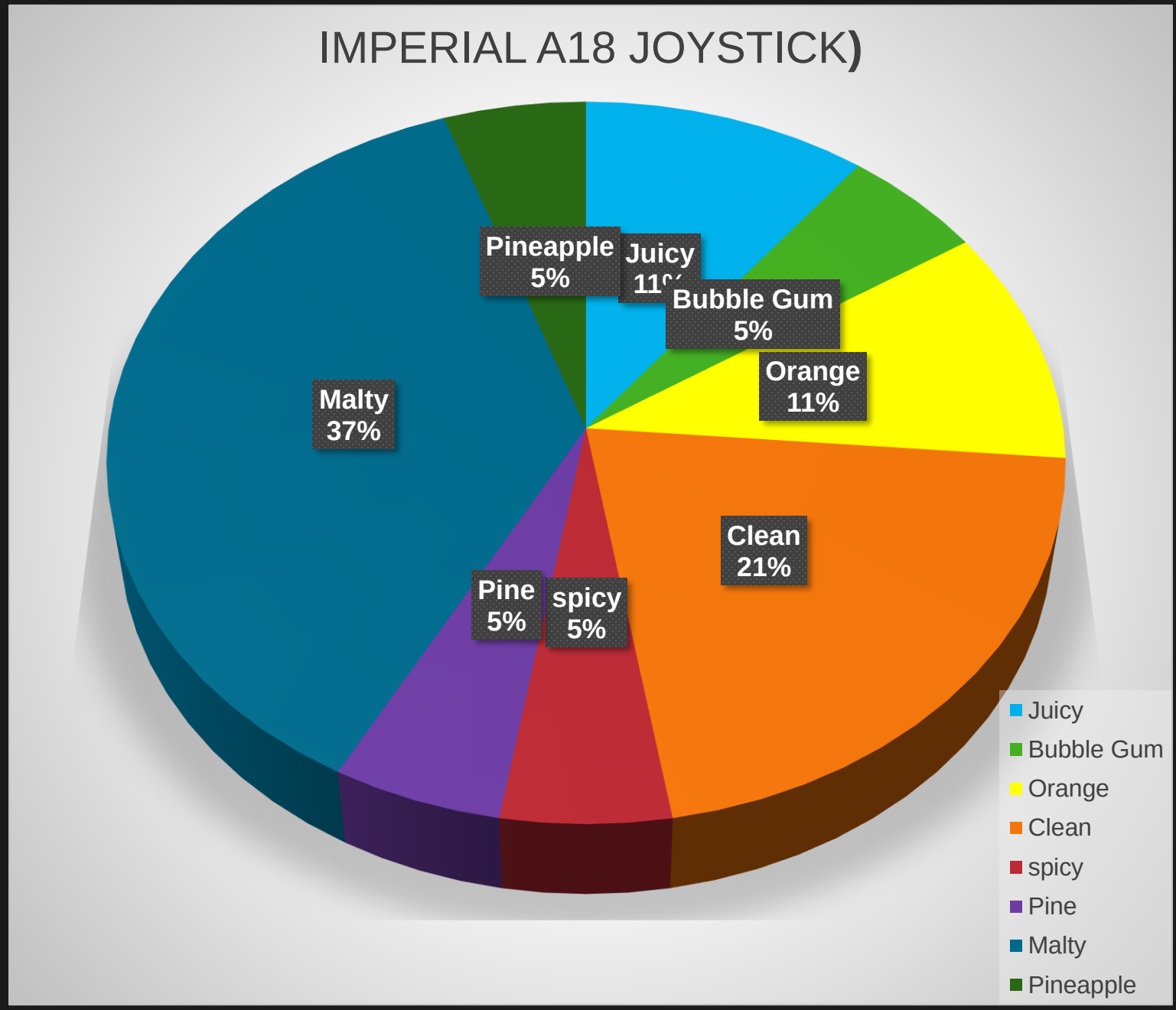
Data/Observations

IMPERIAL A18 JOYSTICK received an overall score of 8.5 out a possible 13.

This was the 3rd via overall average, not a statistical average.

The pie chart to the right is the Aroma/flavor profile that the yeast theatrically Imposed or left neutral on late hop kettle additions, as well as some yeast esters.

Final Note all beers reviewed approximately a month after Packaging.



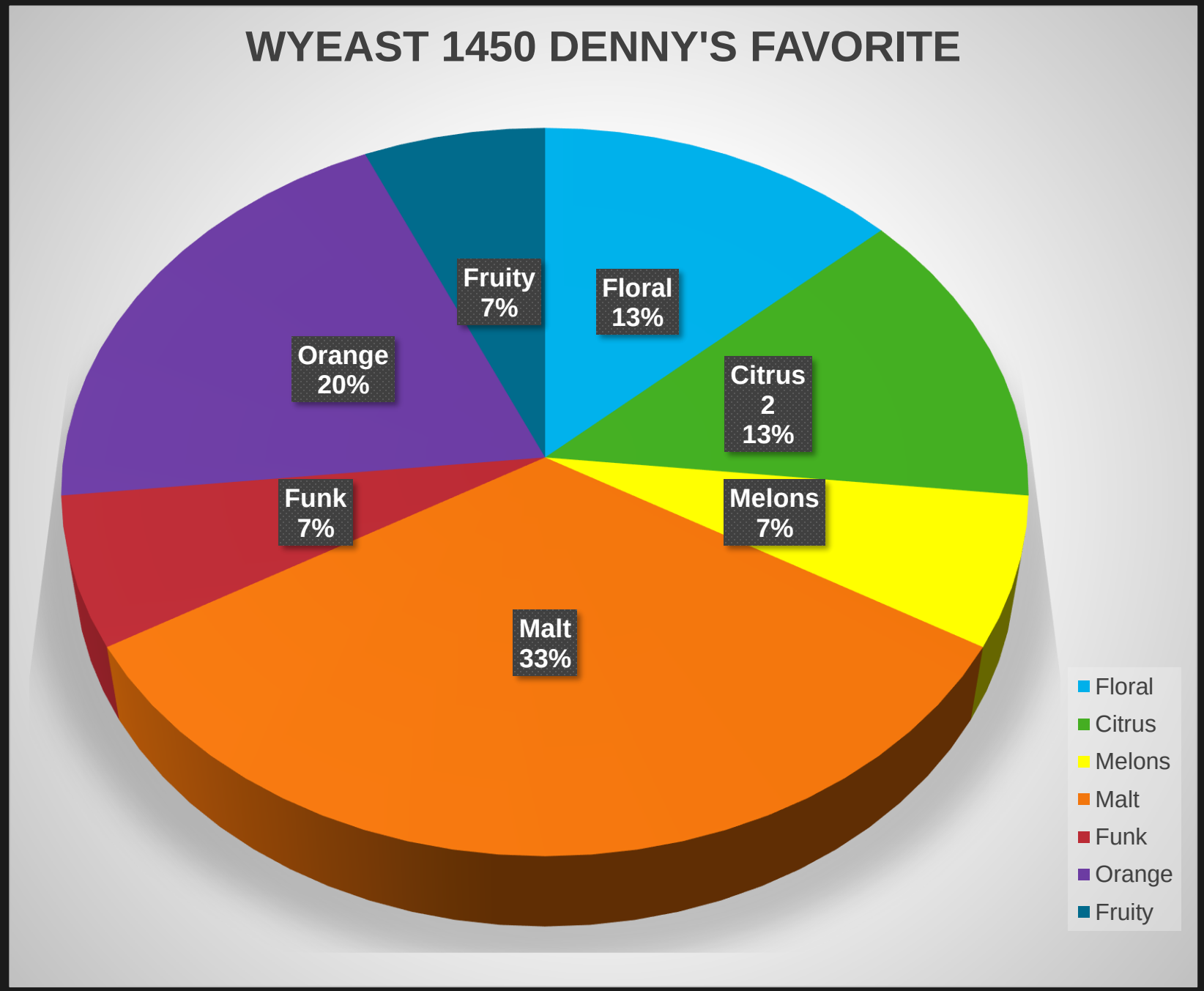
Data/Observations

WYEAST 1450 DENNY'S FAVORITE received an overall score of 8.2 out a possible 13.

This was 4th score via overall average, not a statistical average.

The pie chart to the right is the Aroma/flavor profile that the yeast theatrically Imposed or left neutral on late hop kettle additions, as well as some yeast esters.

Final Note all beers reviewed approximately a month after Packaging.



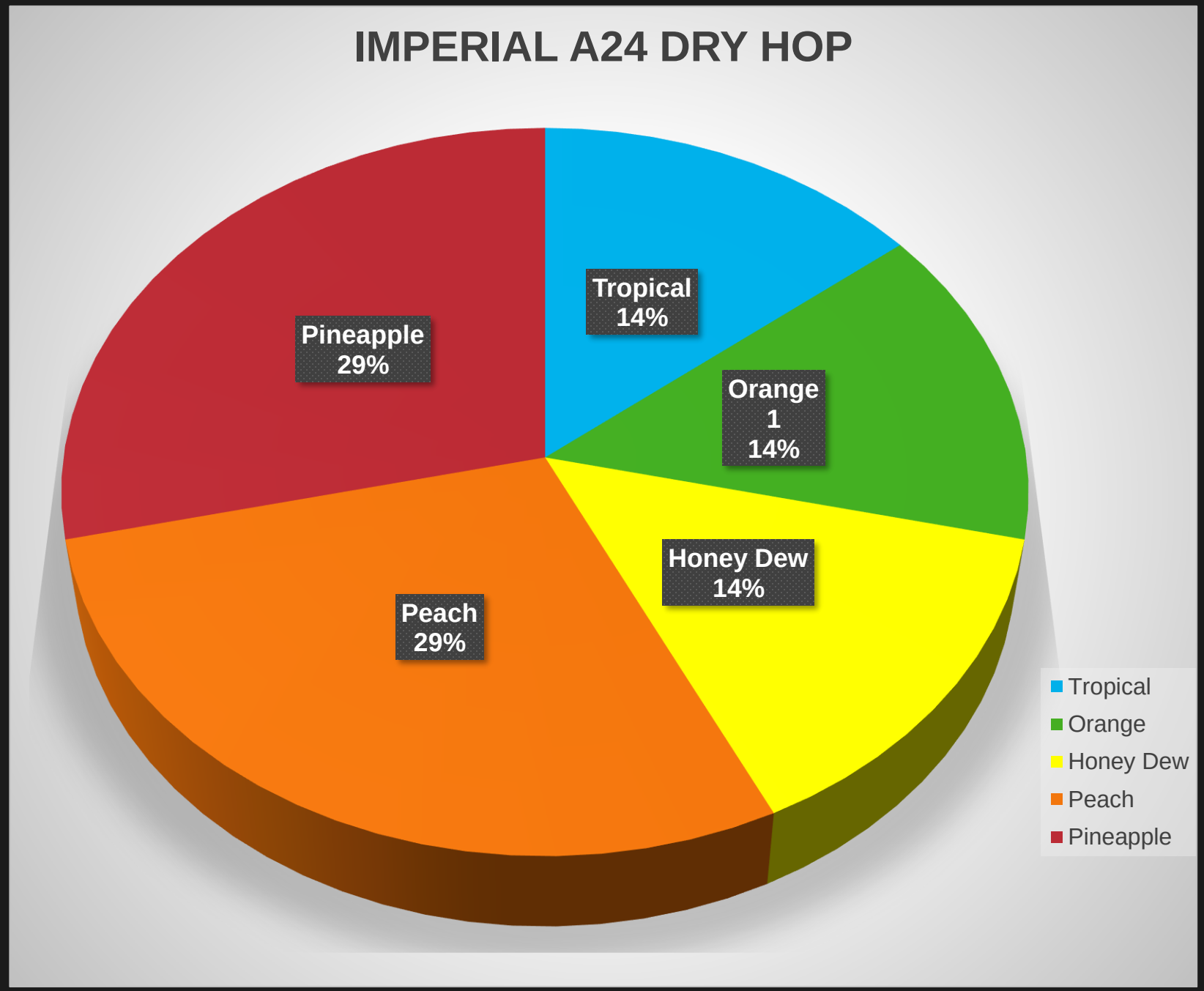
Data/Observations

IMPERIAL A24 DRY HOP received an overall score of 8 out a possible 13.

This was 5th score via overall average, not a statistical average.

The pie chart to the right is the Aroma/flavor profile that the yeast theatrically Imposed or left neutral on late hop kettle additions, as well as some yeast esters.

Final Note all beers reviewed approximately a month after Packaging.



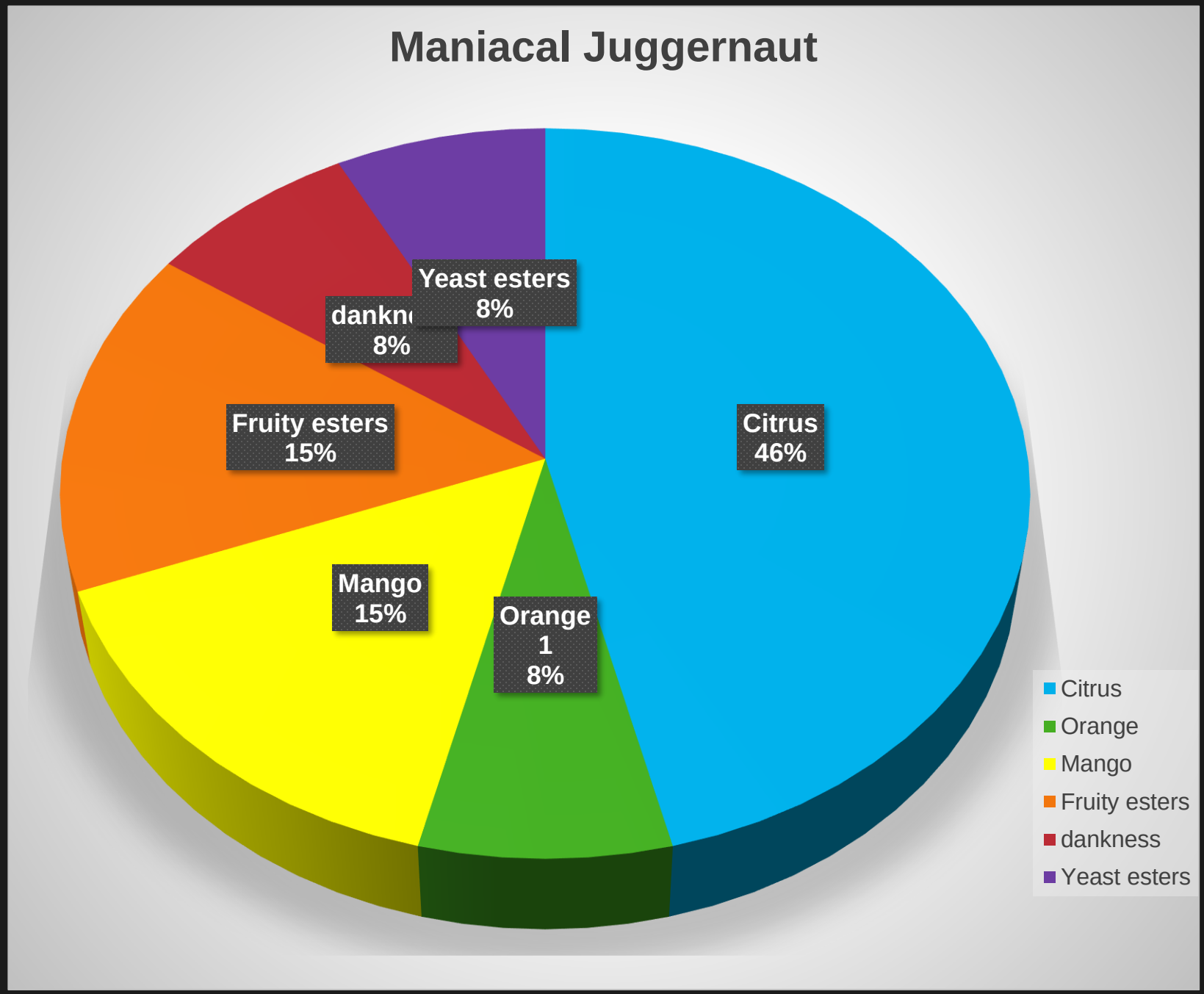
Data/Observations

Maniacal Juggernaut received an overall score of 8 out a possible 13.

This was tied 5th score via overall average, Statistical average places it in 6th.

The pie chart to the right is the Aroma/flavor profile that the yeast theatrically Imposed or left neutral on late hop kettle additions, as well as some yeast esters.

Final Note all beers reviewed approximately a month after Packaging.



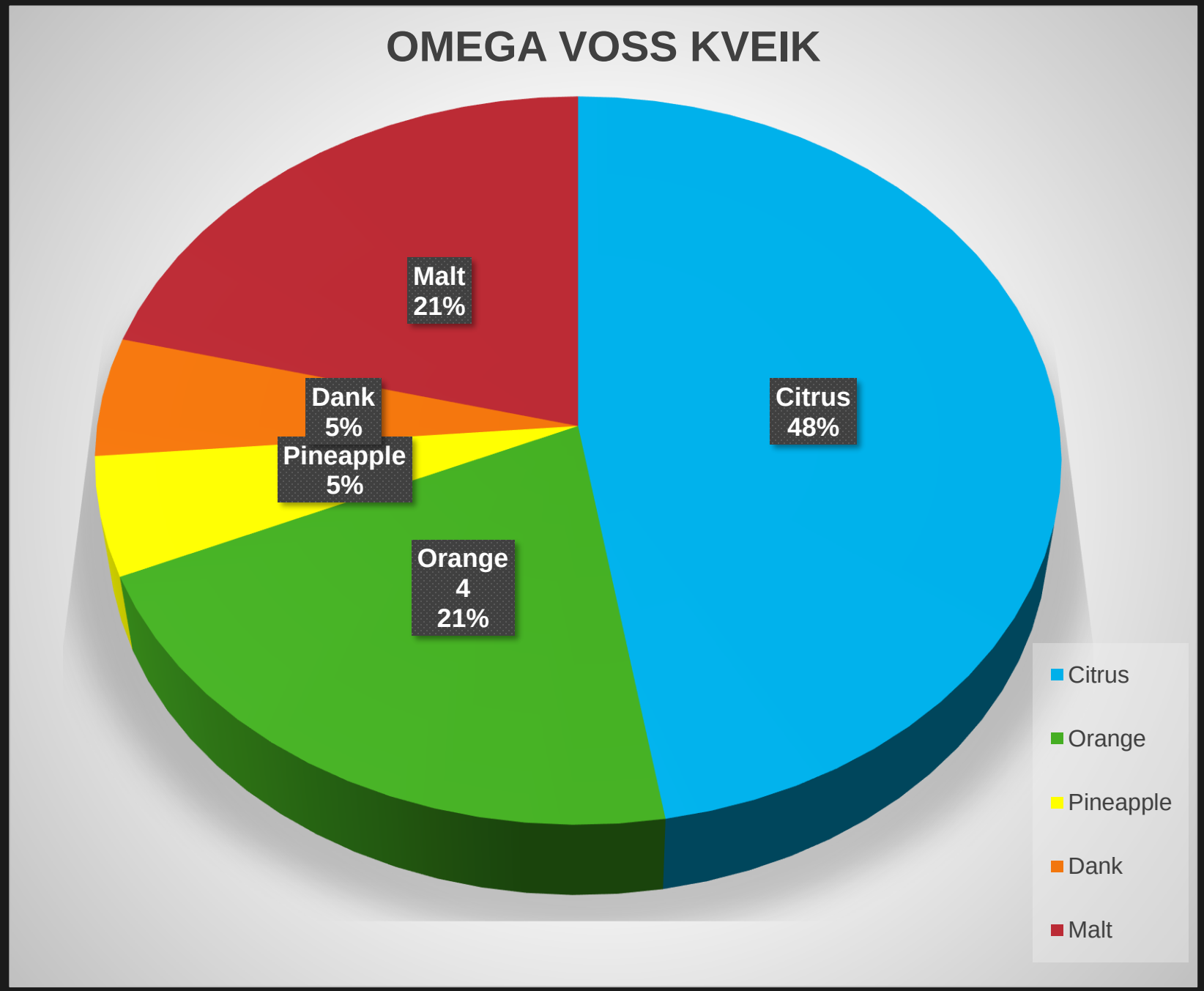
Data/Observations

OMEGA VOSS KVEIK
received an overall score of 7.8
out a possible 13.

This was 7th via overall average, not a statistical average.

The pie chart to the right is the Aroma/flavor profile that the yeast theatrically Imposed or left neutral on late hop kettle additions, as well as some yeast esters.

Final Note all beers reviewed approximately a month after Packaging.



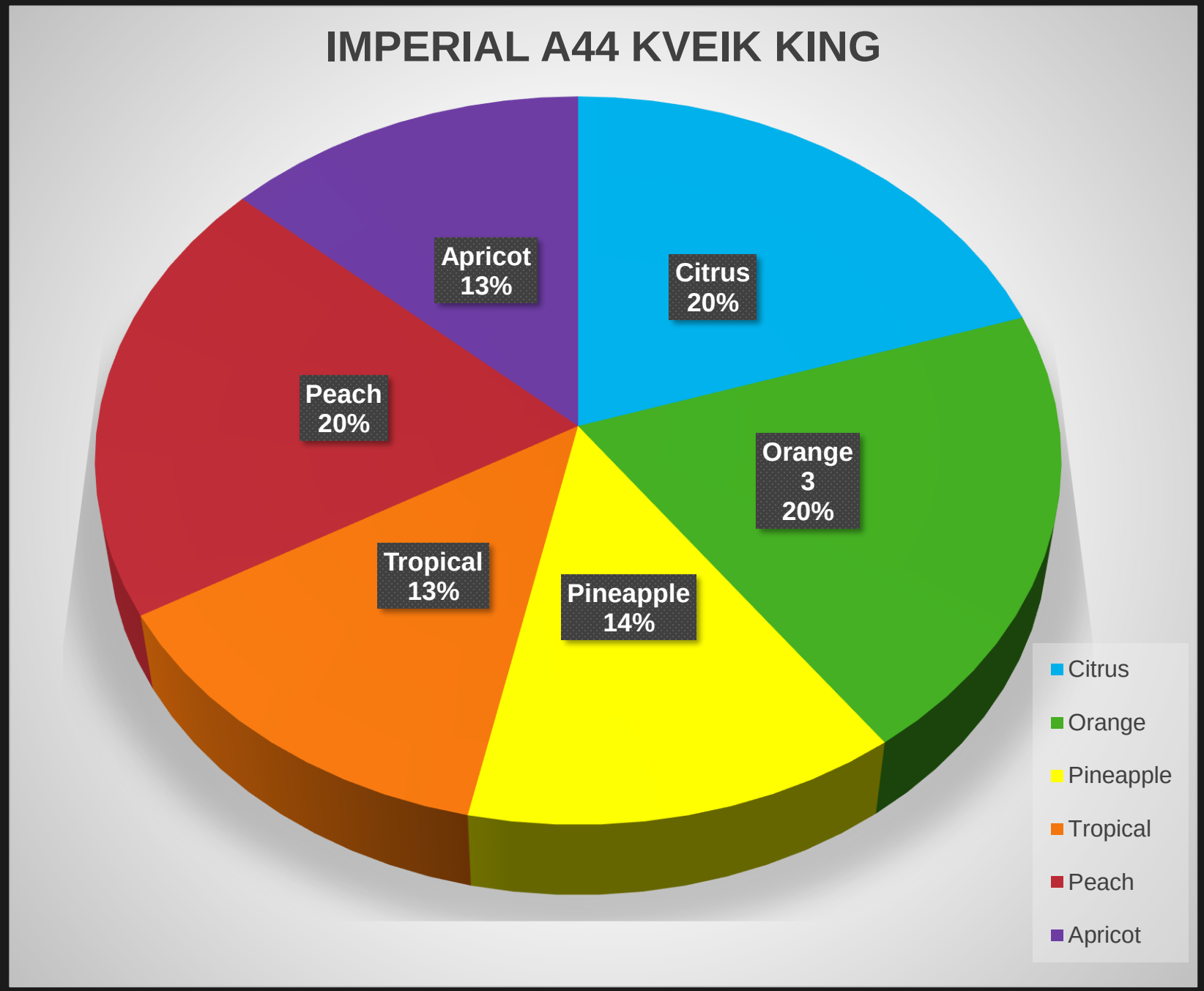
Data/Observations

IMPERIAL A44 KVEIK KING received an overall score of 7.3 out a possible 13.

This yeast was 8th via overall average, not a statistical average.

The pie chart to the right is the Aroma/flavor profile that the yeast theatrically Imposed or left neutral on late hop kettle additions, as well as some yeast esters.

Final Note all beers reviewed approximately a month after Packaging.



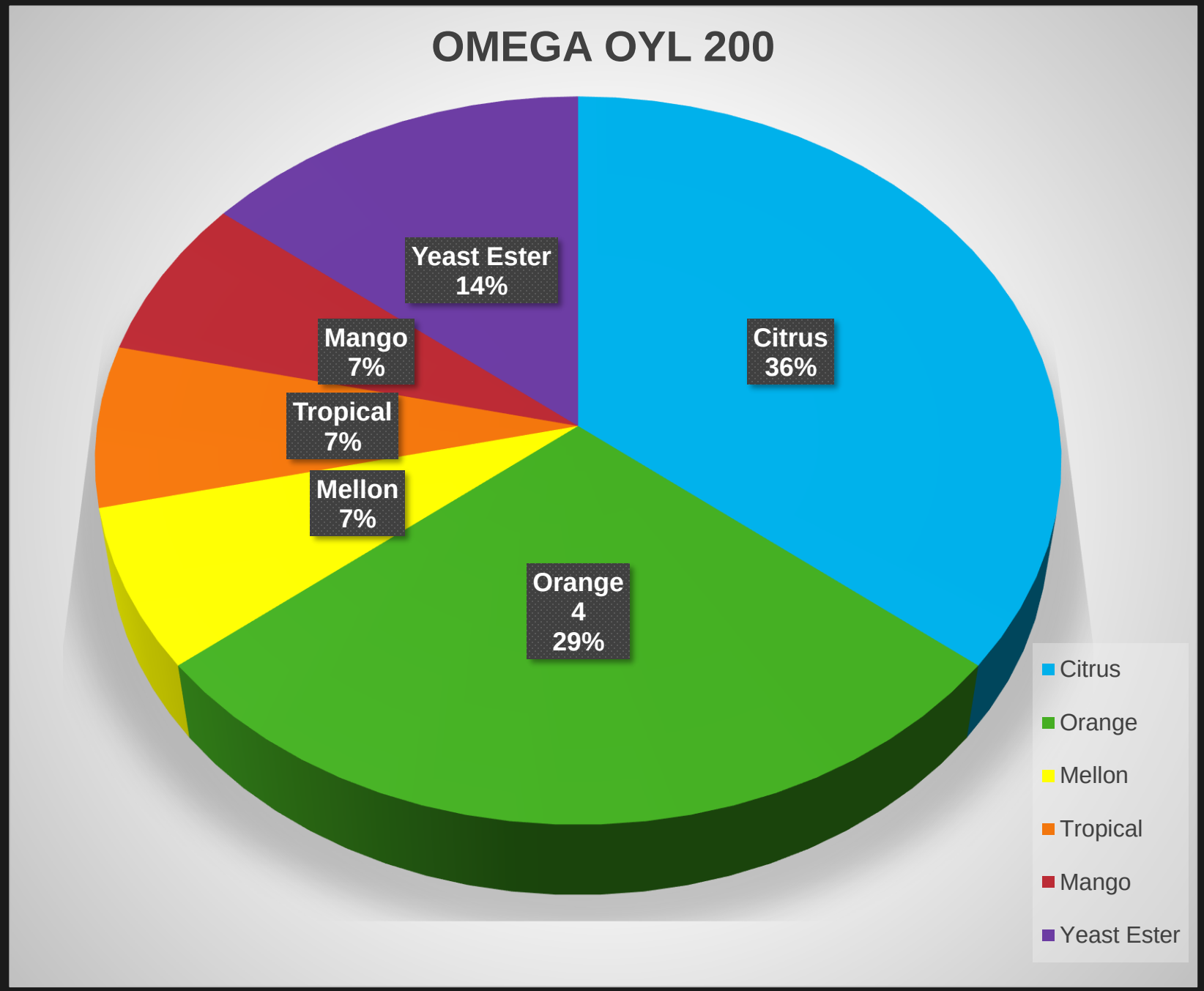
Data/Observations

OMEGA OYL 200
received an overall score of 7 out a possible 13.

This yeast was 9th via overall average, not a statistical average.

The pie chart to the right is the Aroma/flavor profile that the yeast theatrically Imposed or left neutral on late hop kettle additions, as well as some yeast esters.

Final Note all beers reviewed approximately a month after Packaging.



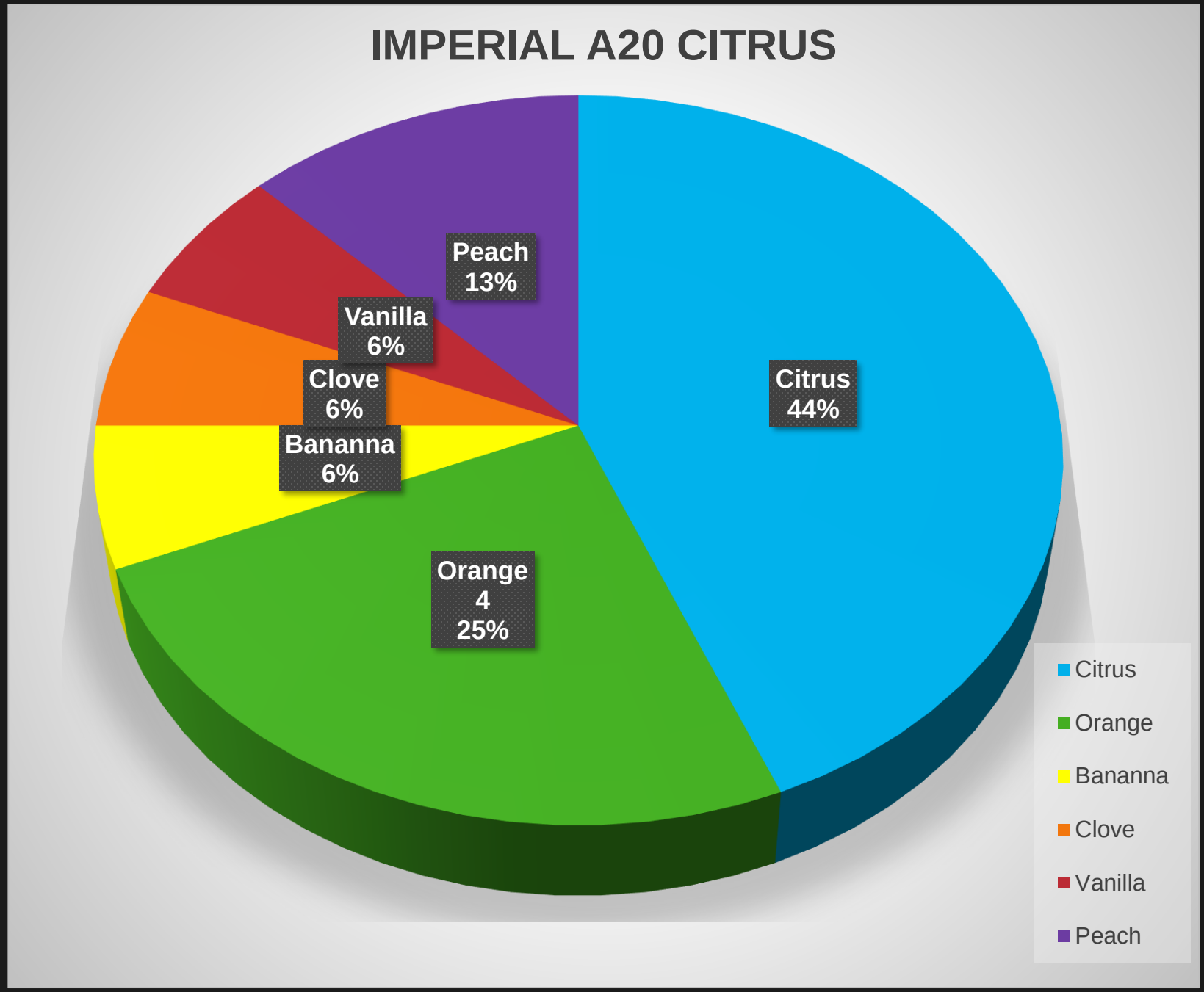
Data/Observations

IMPERIAL A20 CITRUS received an overall score of 6.9 out a possible 13.

This yeast was 10th via overall average, not a statistical average.

The pie chart to the right is the Aroma/flavor profile that the yeast theatrically Imposed or left neutral on late hop kettle additions, as well as some yeast esters.

Final Note all beers reviewed approximately a month after Packaging.



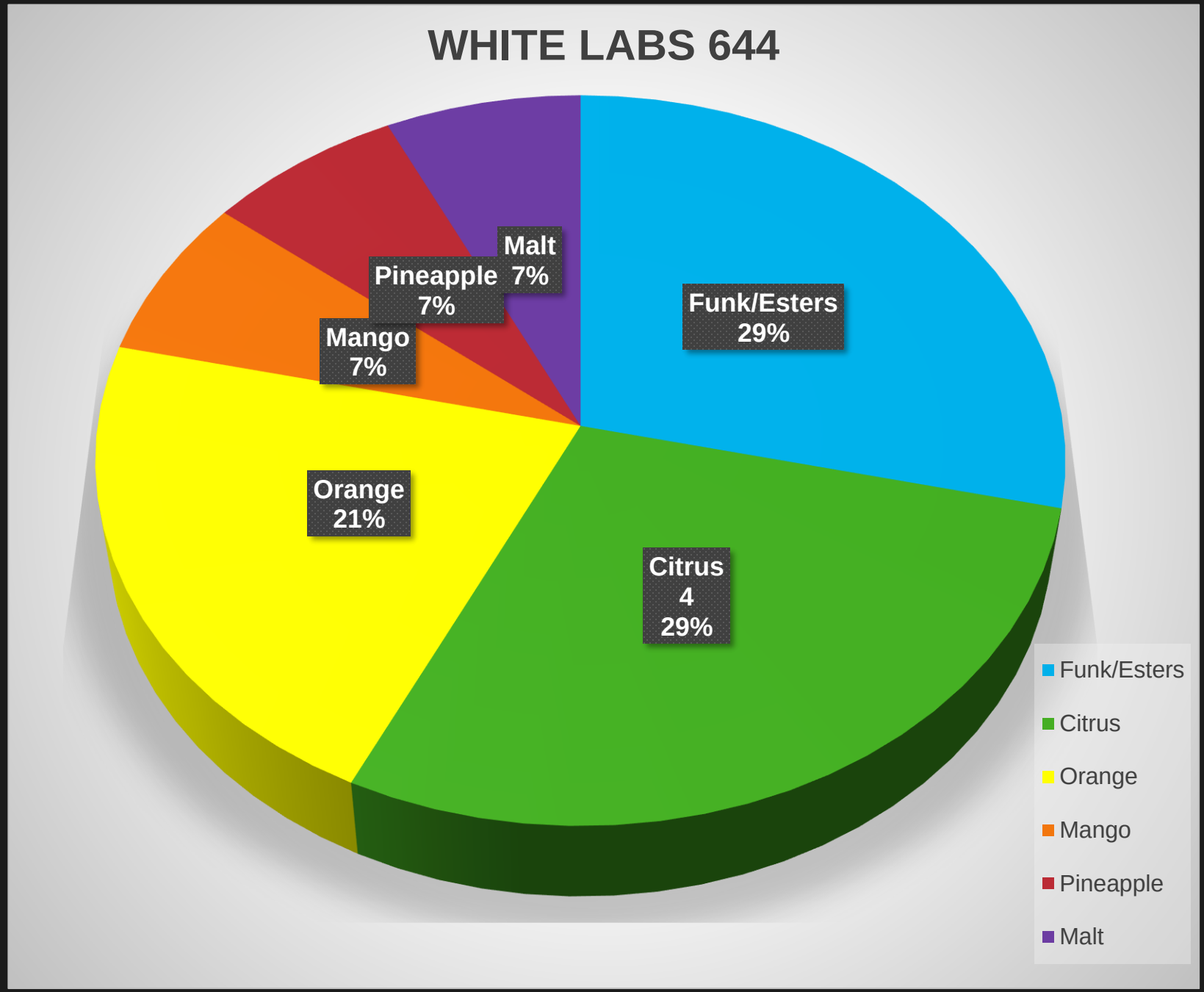
Data/Observations

WHITE LABS 644
received an overall score of 6.9 out a possible 13.

This yeast was tied in 10th via overall average, but 11th in statistical average.

The pie chart to the right is the Aroma/flavor profile that the yeast theatrically Imposed or left neutral on late hop kettle additions, as well as some yeast esters.

Final Note all beers reviewed approximately a month after Packaging.



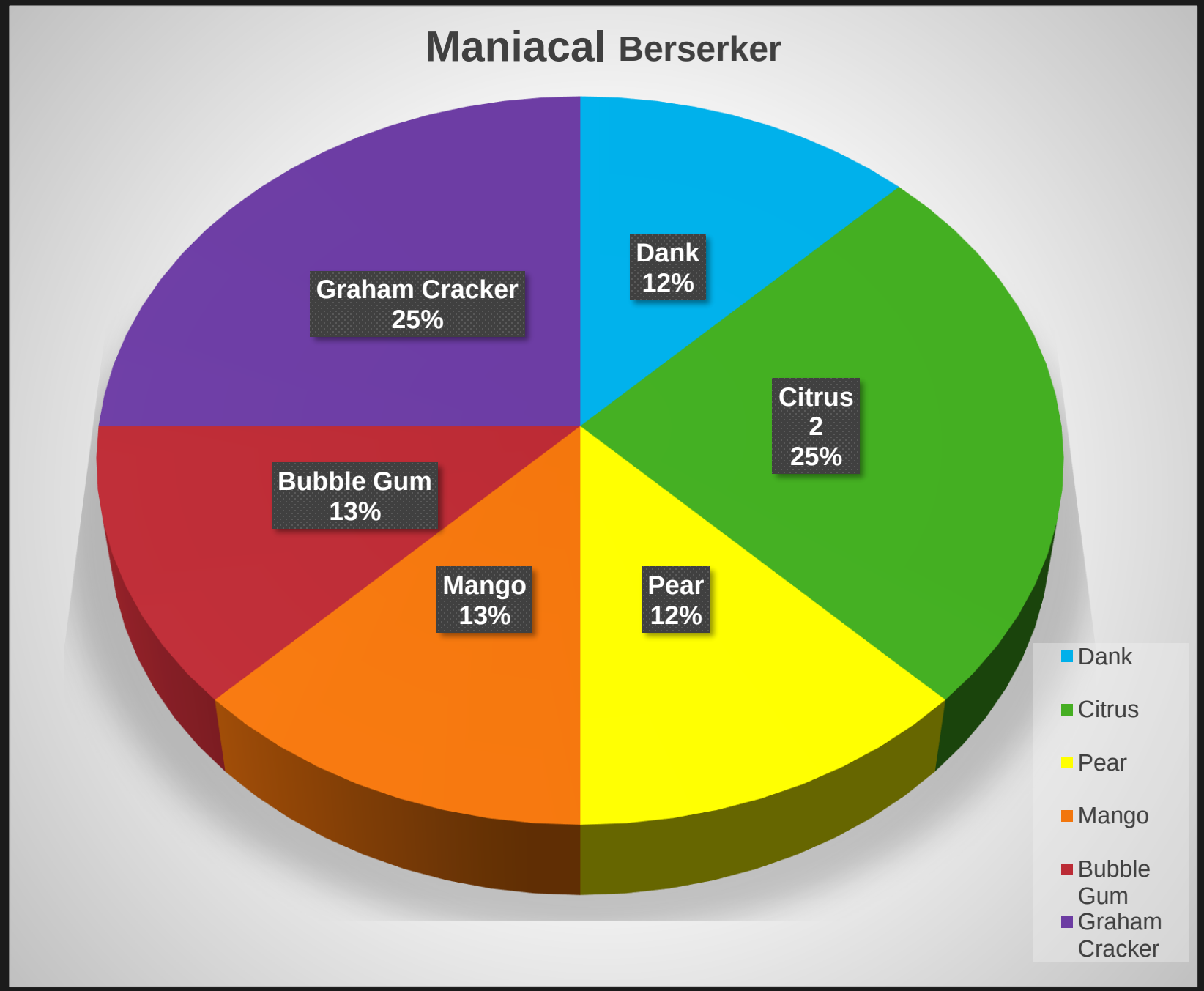
Data/Observations

Maniacal Berserker
received an overall score of 4.2
out a possible 13.

This yeast was 12th via overall average, not a statistical average.

The pie chart to the right is the Aroma/flavor profile that the yeast theatrically Imposed or left neutral on late hop kettle additions, as well as some yeast esters.

Final Note all beers reviewed approximately a month after Packaging.



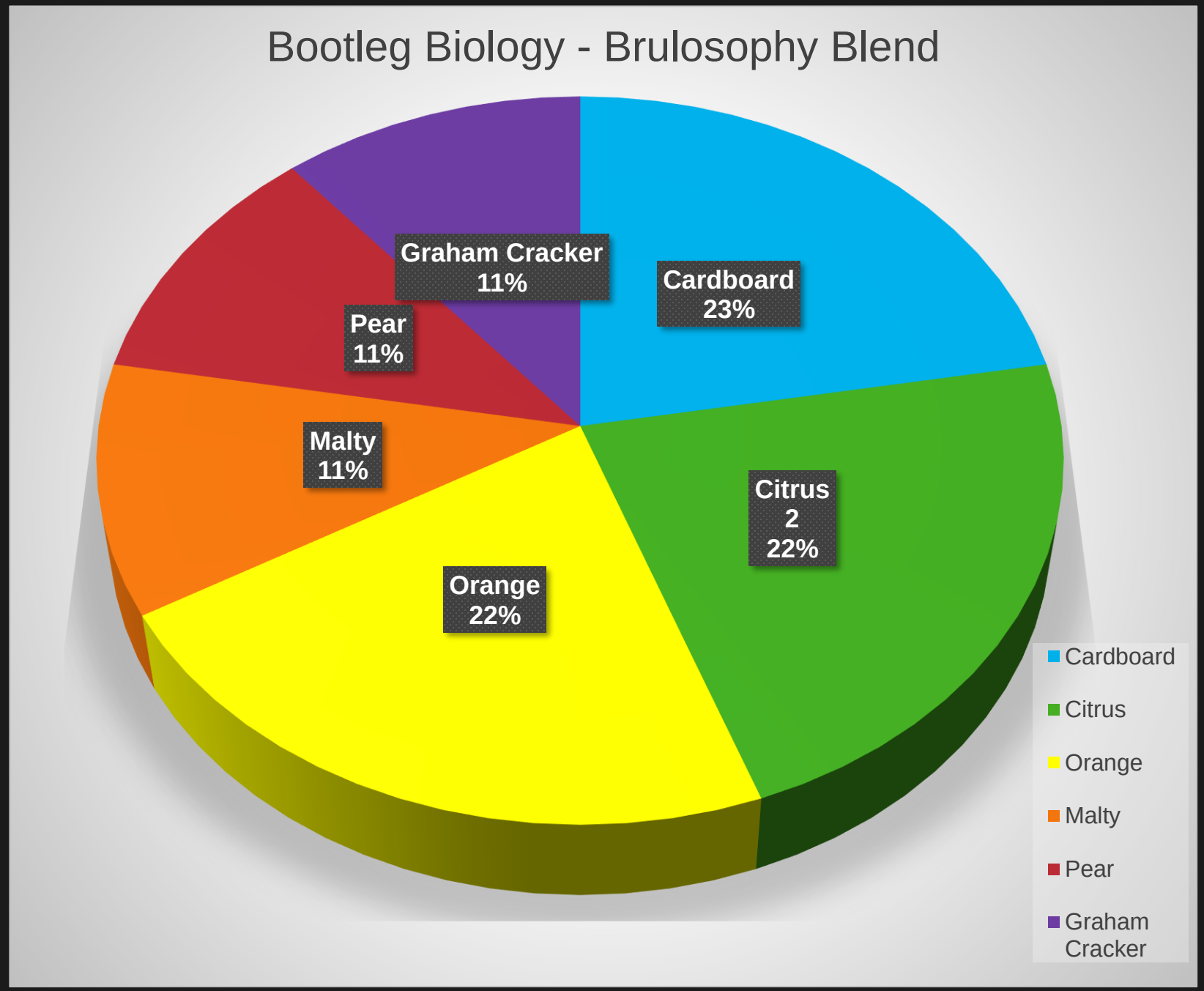
Data/Observations

Bootleg Biology - Brulosophy Blend received an overall score of 4.2 out a possible 13.

This yeast was tied in 12th via overall average, but 13th in statistical average.

The pie chart to the right is the Aroma/flavor profile that the yeast theatrically Imposed or left neutral on late hop kettle additions, as well as some yeast esters.

Final Note all beers reviewed approximately a month after Packaging.



Results

- What influences does yeast have on a standard mild West Coast IPA? Ans: Yeast are known to impart clarity, viscosity, F.G. and yeast esters, but some are capable of transforming final aroma and flavor profiles related to hops.
- Do late kettle hops and whirlpool hops become bio transformed in the final beer? Ans: It appears that some yeast do alter the hop aroma profile in some cases for worse not better.
- Do yeasts higher in Beta-Glucosidase transform late hop Kettle and whirlpool additions by altering the non aromatic glycosides into aromatic linalool citronellol? Ans: this is assumed by the results of this experiment, but are not verified by any laboratory studies. However I am convinced that this action is real. More yeast manufacturers should advertise the amount of Beta-Glucosidase power each yeast is capable of. This information is another tool in proper yeast selection with respect to recipe creation. I.E. If one wish very little biotransformation vs. more biotransformation.
- Eliminate possible yeast biotransformation of dry hopping additions by cold 24 hour dry hop additions prior to a closed transfer to corny keg. This is more a of a statement, however the secondary purpose was to see how much hop aroma was produced using this method. Ans: the amount of aroma was quite large and pleasant at first. It produced a nice aroma without the harsh (green) hop aroma and flavor a 3 day warm dry hop produced. Drawback is that the dry hop profile was fleeting and was virtually gone within a week.
- Try to identify the best yeast for this style of beer with well known hops Ans: Imperial A15 independence

Conclusion

- Although this experiment was not a scientific experiment, the amount of yeast influence was profound.
- It has been known for a long time that yeast do have different profiles which is why they are used in different beer styles. Yeast impart yeast esters known for a particular style.
- What we have been discovering over the last few years is that yeast bio transform late kettle and whirlpool hop additions, and this experiment supports this theory.
- Not all yeast manufacturers have advertised the amount of yeast β-glucosidase levels, but some do I.E. Lallemand. It is know that some yeast have a greater level of β-glucosidase level, which is the mechanism of hydrolysis of hop oils which can produce many different aromatic/flavor profiles. (some positive, some negative).
- Based on the aroma/flavor profiles during this experiment, a clear change in non aromatic glycosides into aromatic linalool and citronellol was expressed.
- The flavor and aroma profiles identified from the participants reviews show both Linalool (citirus type aromas) and Citronellol (floral type) from the same recipe.

Works Cited

- Lallemandbrewing.com. 2020. [online] Available at: <https://www.lallemandbrewing.com/wp-content/uploads/2017/03/LAL-bestpractices-Biotransformation-digital-1.pdf> [Accessed 21 April 2020].
- Janish, S., & Hieronymus, S. (2019). *The new Ipa: scientific guide to hop aroma and flavor*. Lexington, KY: ScottJanish.com.