Can Whiskey have Terroir?

Comparative Analysis of Corn Strains for Optimal Sugar Production in Bourbon Whiskey

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Abstract

Five tropical corn hybrid varieties from the 200+ member library were bred and grown at Texas A&M (TAMU) in College Station. Each variety was grown in duplicate on the same field to control for all noise associated with field variability.

Grain delivered to the laboratory at F&R Distilling Co was first ground in a controlled manner and mashed using a standard protocol with the aid of amylase enzymes. The mash was analyzed for both pH and specific gravity to show progression of fermentation.

Subsequently, the mash was fermented using proprietary yeast and the pH and specific gravity of the wash was remeasured.

The data suggests that some examined strains merit further consideration for flavor analysis following distillation.

Texan Terroir

Terroir is a specific flavor dependent on local environment, a term commonly associated with wine.

The goal of of F&R Distilling Co is to have a uniquely Texan flavor based on locally sourced ingredients, such as local yeast isolated from pecans and corn indigenous to Texas.

Corn varieties will be prioritized based on their ability to yield product with desirable flavor. This is heavily dependent on which sugars (such as glucose, maltose) are accessible in what quantities. However, flavor is important only if the product is economically viable. The sugar must be present in high enough quantities to fuel fermentation to yield sufficient quantities of alcohol.

Genetic differences → **Sugar content** → **Alcohol yield** → **Whiskey Flavor**

Acknowledgements

reSEaRCh Science and Engineering Research Center

Firestone and Robertson Distillery, especially Rob Arnold and Ale Ochoa

Developed Methods of Whiskey Production

In the distillery

In the research lab

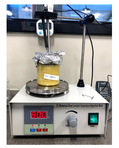
Grain

Whiskey contains barley, wheat, rye, and/or corn, but bourbon is primarily made of corn.

Mill

Milling uses a grind-stone to physically break down the tough corn kernels into a fine powder.

Mash



Cooking the corn in water, added amylase enzymes break starch into fermentable sugars.

Each strain of corn has two replicates in the field, and each field replicate has two batches processed in the lab.

The corn is ground through a grindstone at a uniform qualitative setting. This produces a fine grain flour that can easily be mixed into solution.

Corn is added to water and brought to a high temperature. Equipment ensures constant agitation, and various amylase enzymes are added along with a proprietary local Texan yeast.

Analyze Mash pH and Specific Gravity (S.G.)

Ferment

Fermentation occurs when yeast in the mash turns sugars into alcohol.

The mash sits for several days to naturally ferment, where the enzymes change the various sugar groups into alcohol.

Analyze Beer pH and Specific Gravity (S.G.)

Distill

Distillation turns the fermented mash (beer) into more concentrated alcohol through boiling.

Whiskey would then normally undergo the process of distillation in a still. Here, the beer is boiled and alcohol vapor is collected off the top. This vapor is then cooled to condense it into a high-proof liquid.

Mature

After condensation of the alcohol-rich vapors into liquid, the 'moonshine' is barreled in charred, new white oak casks and matured for 3+ years

To complete the process, the distilled liquor would rest in oak barrels. Texan flavor is imparted through the drastic temperature changes characteristic of this region: hot, humid summers push the liquid into the wood, and winters brings the liquor back inside, carrying notes of oak flavor with it.

Whiskey

Lastly, the whiskey is bottled, labelled, and evaluated to improve further production.

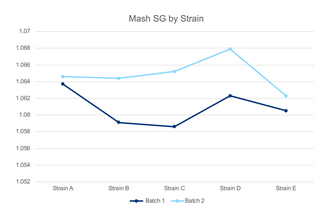
Before the whiskey can be bottled, certain barrels are blended together to achieve a particular flavor. This flavor is dependent on many things, including the corn variety.

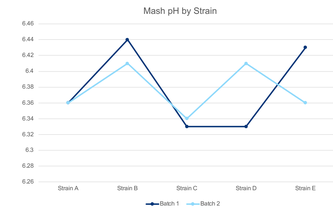
Data

Specific Gravity (S.G.)

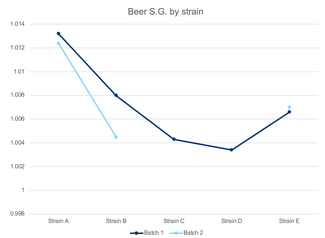
pH

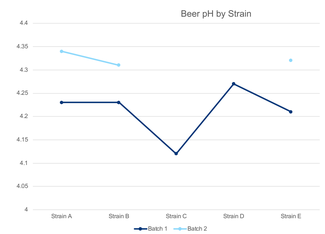
Two batches of S.G. and pH over five replicates mashes





Two batches of S.G. and pH over three - five replicate beers





Analysis

There is a supported difference between parent one and pH and parent two and S.G., based on a comparative heritage of Strains A,B,C,D, and E. However, this difference is not statistically significant at this number of samples. Further testing would likely indicate a stronger correlation.
There was a significant amount of difference in these samples between Batches 1 and 2. Procedures need to be be reviewed to control for all non-genetic variation, with the ultimate goal of eliminating any variability between Batch 1 and Batch 2.

Future Directions

1. Standardize procedures to control for all variables possible, eliminating most of the difference between Batch Replicates one and two.
2. Run HPLC analysis of both Set (Mash) and Drop (Beer) data to determine quantities and characterization.
3. Continue processing the 200 corn varieties for pH, S.G., and HPLC data to assess sugar content.
4. Assess this data for trends in parent strains to select for most promising seed.