Does terroir exist for whiskey?

Eddie Harpur's farm, Bannow Island, Co. Wexford (photo by Caolan Barron).

TEAGASC research is investigating whether a terroir effect could influence the quality of Irish whiskey.

Irish whiskey (uisce beatha Eireannach) is one of the oldest spirit drinks in Europe and is a geographical indication product approved by the EU, which is a designation used to identify a product whose quality and reputation is linked to its geographical origin. Whiskey is produced from a mash of malted cereals, with or without whole grains of other cereals. The general classification 'Irish whiskey/uisce beatha Eireannach/Irish whisky' contains three categories: 'pot still Irish whiskey/Irish pot still whiskey', 'malt Irish whiskey/Irish malt whiskey', and 'grain Irish whiskey/Irish grain whiskey', which can also be combined to form a 'blended Irish whiskey/Irish blended whiskey'.

Whiskey production

Malting is defined as the controlled germination of cereals, which prepares the starch to be converted into fermentable sugars. The malt is mixed with hot water (mashing) to allow the starch to be converted into sugar by natural enzymes. After the separation of the grains, the sweet sugary liquid remaining is known as wort. The wort is subsequently fermented by yeast and the sugars are converted to alcohols.

During the fermentation process a high number of volatiles are produced, and the final fermented liquid is known as the wash.

The wash is distilled in either pot stills or column stills. The first stage distillate is termed 'low wines' (LW), with an alcoholic strength by volume (ABV) of ~20/25 %. The next distillation occurs in the spirit still and different fractions are collected via condensation; the first and third are called foreshots and feints, respectively, and are recycled back to the LW.

The middle cut is collected until the alcohol content is reduced to ~60 % ABV in the spirit (S). The S may be double or triple distilled, according to the choice of individual distilleries, and the final alcoholic strength must be no more than 94.8 %. The alcoholic content is reduced with water to 63-70 % before maturation process.

The maturation of the final distillate occurs for at least three years in oak casks with a capacity not exceeding 700 L, which in some cases have been previously used to store other alcoholic beverages. The final Irish whiskey has a minimum alcohol content of 40 % ABV. Natural caramel colouring (E150) is permitted but not always used. The colour of whiskey ranges from pale gold to dark amber, and its aroma and flavour become more complex due to the large amount of odour-active chemical classes produced during the process.

Terroir effect

Although each step of the distilling process plays a vital role in establishing the flavour complexity of the whiskey, the cereal crop imparts a distinctive sensory profile, which is allegedly directly attributable to its geographical origin and therefore may impart a terroir aspect to whiskey.

Terroir is the set of all environmental factors that affect a crop's phenotype, including unique environment contexts, farming practices and a crop's specific growth habitat. Collectively, these contextual characteristics are said to have a character and the term terroir refers to this character. Terroir forms the basis of the French wine appellation d'origine contrôlée (AOC) system, which is a model for wine appellation and regulation in France and around the world. However, terroir has not been established for whiskey, and it is not clear if distillation enhances or reduces potential effects. Recent studies have linked barley genotype to beer flavour and composition (Herb *et al.*, 2017; Bettenhausen, *et al.*, 2018), highlighting a

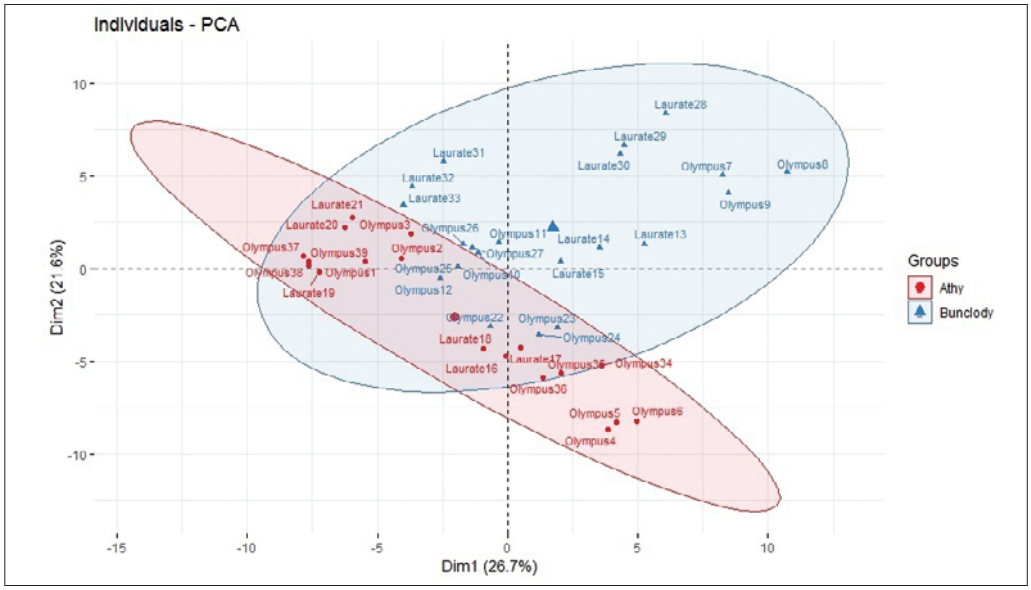

FIGURE 1: PCA plot and groups of spirits according to the origin of the barley (location).

potential terroir impact for the brewing industry, suggesting a possibility for whiskey.

Enterprise Ireland, through the Innovation Partnership Programme, has funded a project with Waterford Distillery and Teagasc to investigate the potential of terroir in Irish whiskey distillates. A multivariate statistical approach is used to determine the impact of volatiles arising from the phenotypic expression of barley produced at different geographical locations that may impact on the sensory characteristics of the resulting distillates.

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Experimental design

During this experiment, barley from two varieties (Olympus and Laureate), and at two distinct locations (Athy, Co. Kildare, and Bunclody, Co. Wexford) was harvested, processed, malted and fermented. Micro-distillations were undertaken and samples from different stages of whiskey production (LW, S, foreshots and feints) were collected.

The volatile profiles of the samples were investigated using head space solid phase micro-extraction gas chromatography mass spectrometry (HS-SPME GCMS). The statistical analysis of the results was undertaken using principal component analysis (PCA).

Results

A total of 78 volatile compounds were identified in preliminary LW and S samples. Esters were the most common flavour chemical class and they also had the most significant contribution to the differentiations among the treatments. PCA plots were generated to evaluate the variation and the possible effect among the volatile profiles of the samples. **Figure 1** is a PCA biplot of S samples produced from both barley types (Olympus and Laureate) from both sites (Athy and Bunclody). It is apparent that a greater discrimination exists for location than for barley variety, which seems to imply that terroir may be a factor in Irish whiskey. Further studies are ongoing.

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Authors

Kieran Kilcawley
Teagasc Food Research Centre, Moorepark, Fermoy, Co. Cork
Correspondence: kieran.kilcawley@teagasc.ie

Maria Kyraleou
Teagasc Food Research Centre, Moorepark, Fermoy, Co. Cork