

Assessment of Pinnacle MG+ yeast for the Scotch whisky industry

Alan Storr¹ and Jane W Walker²

AB Mauri, Sugar Way, Peterborough¹ and Scotch Whisky Research Institute, Edinburgh²



Introduction

The Scotch whisky sector has for some years been looking for a yeast that will achieve their demands for better temperature, alcohol and gravity tolerance alongside improved sugar conversion in the form of rate and yield. Final spirit quality is still required to meet the organoleptic properties of the distillery.

AB Mauri has been working on the development of a new strain, Pinnacle MG+, as an alternative to their standard Pinnacle yeast. A detailed comparison of Pinnacle MG+ and Pinnacle was carried out under controlled laboratory conditions. A range of fermentation parameters were studied, such as gravity and temperature profile. The impact on spirit composition and flavour were also examined through a detailed analytical and sensory analysis of spirits produced.

Materials and methods

Yeast and wort

Two yeast strains, Pinnacle MG+ and Pinnacle, were tested in cream format. Yeast viabilities were >98% viable.

Unpeated wort was obtained from a Scotch malt whisky distillery. Wort gravities were adjusted to OG 1060° and 1080°, and pH values were recorded as 5.57 and 5.36, respectively.

Fermentation trials

Controlled fermentation trials were carried out to compare performance in standard and high gravity wort at both standard and high temperatures. Details in Table 1.

Table 1 – Fermentation conditions for Trial 1 and Trial 2

Yeast strain	Trial 1: Standard Temperature (18-34°C)		Trial 2: High Temperature (18-38°C)	
	Standard OG	High OG	Standard OG	High OG
Pinnacle	1060°	1080°	1060°	1080°
Pinnacle MG+	1060°	1080°	1060°	1080°

The standard temperature profile was based on data obtained malt distillery fermentations. The high temperature profile, was increased to stress the yeast, and used a maximum temperature of 38°C that would effectively kill 'normal' distilling yeast strains. A fermentation time of 64 hours was used for all trials.

Trial 1 - Wash analysis results – standard temperature (18-34°C)

Table 2 – Standard temperature / Standard gravity

Fermentation Code	Wash Alcohol Strength (%abv)	Wash Density (g/m3)	Final Gravity (FG°)	Degrees Under (1000-FG)	Wash pH
Pinnacle 1060°	8.35	0.994	997.34	-2.66	4.37
Pinnacle 1060°	8.29	0.994	997.65	-2.35	4.42
MG+ 1060°	8.40	0.993	996.34	-3.66	4.20
MG+ 1060°	8.45	0.993	996.52	-3.48	4.23

Both yeasts achieved similar alcohol yields, Pinnacle MG+ achieved slightly higher alcohol strengths than Pinnacle.

Table 3 – Standard temperature / High gravity

Fermentation Code	Wash Alcohol Strength (%abv)	Wash Density (g/m3)	Final Gravity (FG°)	Degrees Under (1000-FG)	Wash pH
Pinnacle 1080°	10.97	0.996	999.79	-0.21	4.64
Pinnacle 1080°	10.86	0.997	1000.26	+0.26	4.65
MG+ 1080°	11.23	0.994	997.38	-2.62	4.64
MG+ 1080°	11.10	0.994	997.48	-2.52	4.62

Pinnacle MG+ produced higher alcohol yields than Pinnacle at OG 1080°, demonstrating greater osmotolerance.

Trial 2 - Wash analysis results – high temperature (18-38°C)

Table 4 – High temperature / Standard gravity

Fermentation Code	Wash Alcohol Strength (%abv)	Wash Density (g/m3)	Final Gravity (FG°)	Degrees Under (1000-FG)	Wash pH
Pinnacle 1060°	8.23	0.996	999.31	-0.69	4.50
Pinnacle 1060°	8.06	0.997	999.94	-0.06	4.43
Pinnacle 1060°	8.16	0.996	999.36	-0.64	4.49
MG+ 1060°	8.45	0.994	997.48	-2.52	4.45
MG+ 1060°	8.45	0.994	997.68	-2.32	4.47

Pinnacle lost alcohol yield at the higher temperature (compared to Table 2), whereas Pinnacle MG+ produced the same alcohol yield as before, confirming that it is a more thermotolerant strain.

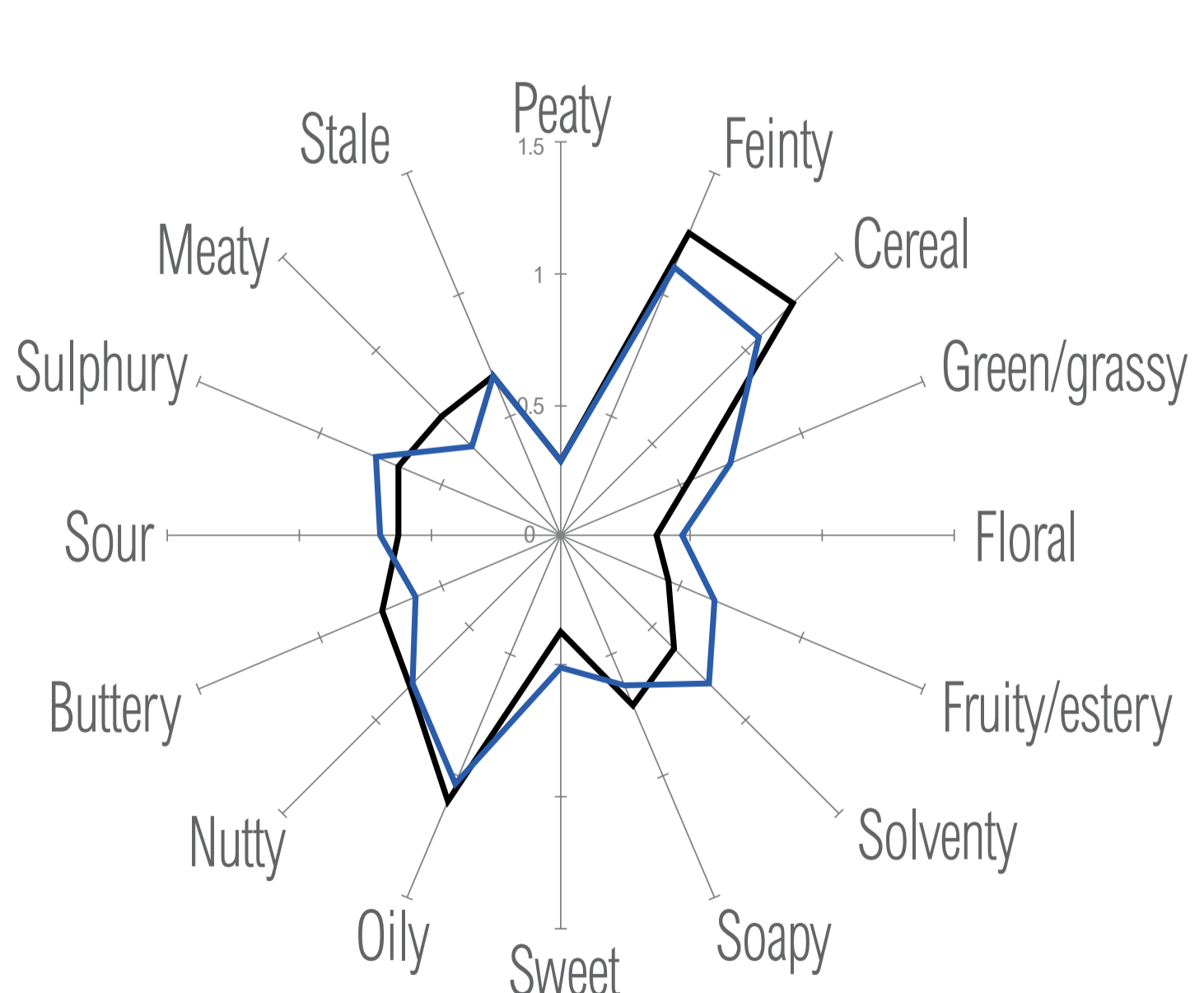
Table 5 – High temperature / High gravity

Fermentation Code	Wash Alcohol Strength (%abv)	Wash Density (g/m3)	Final Gravity (FG°)	Degrees Under (1000-FG)	Wash pH
Pinnacle 1080°	10.32	1.000	1003.61	+3.61	4.71
Pinnacle 1080°	10.17	1.001	1004.78	+4.78	4.72
MG+ 1080°	11.02	0.996	999.37	-0.63	4.75
MG+ 1080°	11.03	0.996	999.35	-0.65	4.75
MG+ 1080°	11.17	0.995	998.67	-1.33	4.75

Pinnacle yeast was stressed under these conditions resulting in stuck fermentations and loss of alcohol yield. In contrast, Pinnacle MG+ produces more than >11%abv indicating that although there is a slight loss in alcohol yield (compared to Table 3), Pinnacle MG+ shows greater resilience and stress-tolerance under these adverse conditions.

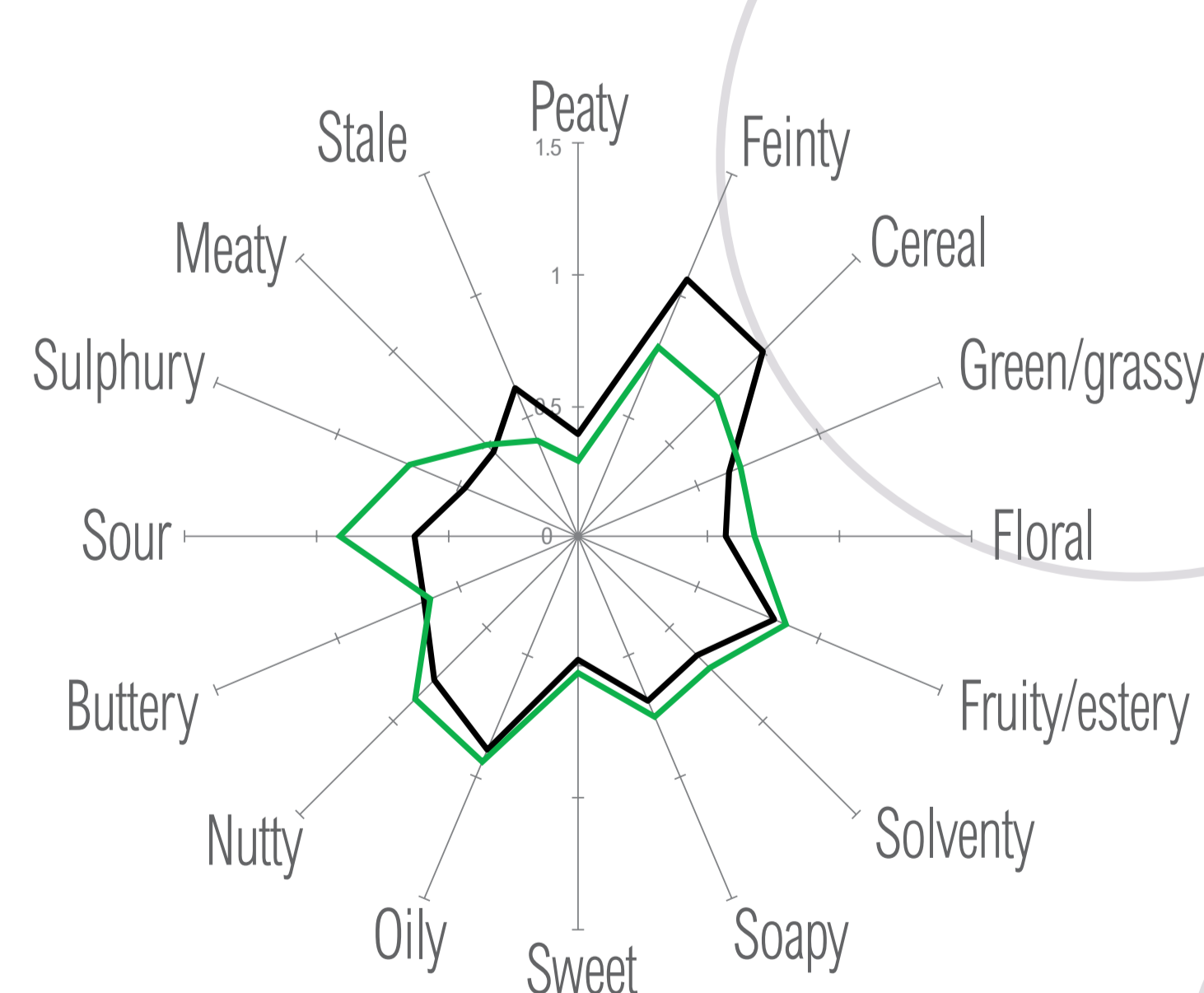
Sensory analysis – comparison of flavour profiles under different fermentation conditions

Standard temperature / Standard gravity



— Pinnacle, OG 1060° — MG+, OG 1060°

Standard temperature / High gravity

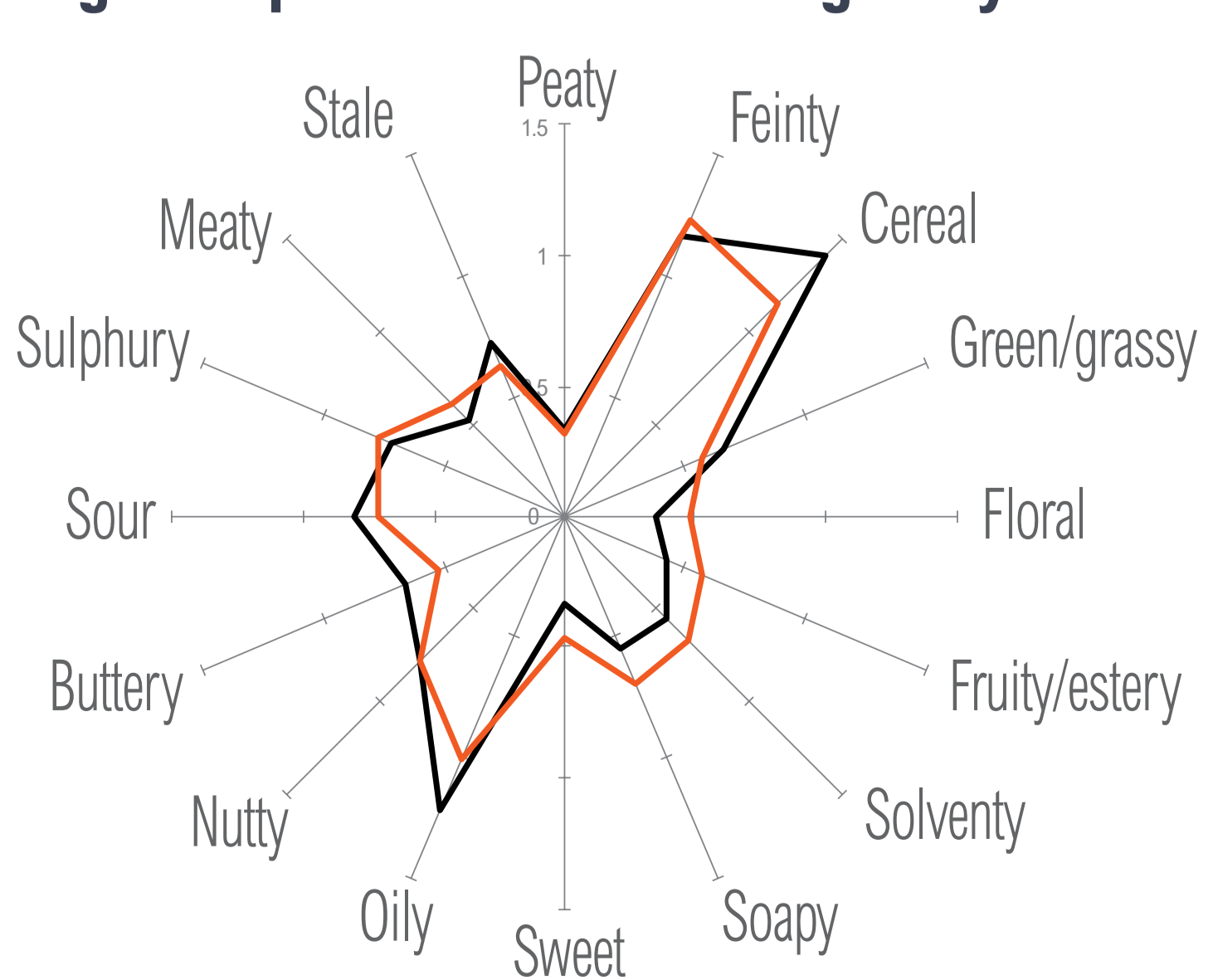


— Pinnacle, OG 1080° — MG+, OG 1080°

Fermented wash was distilled in lab-scale copper stills to produce new make spirits that were assessed by a trained sensory panel using Quantitative Descriptive Analysis.

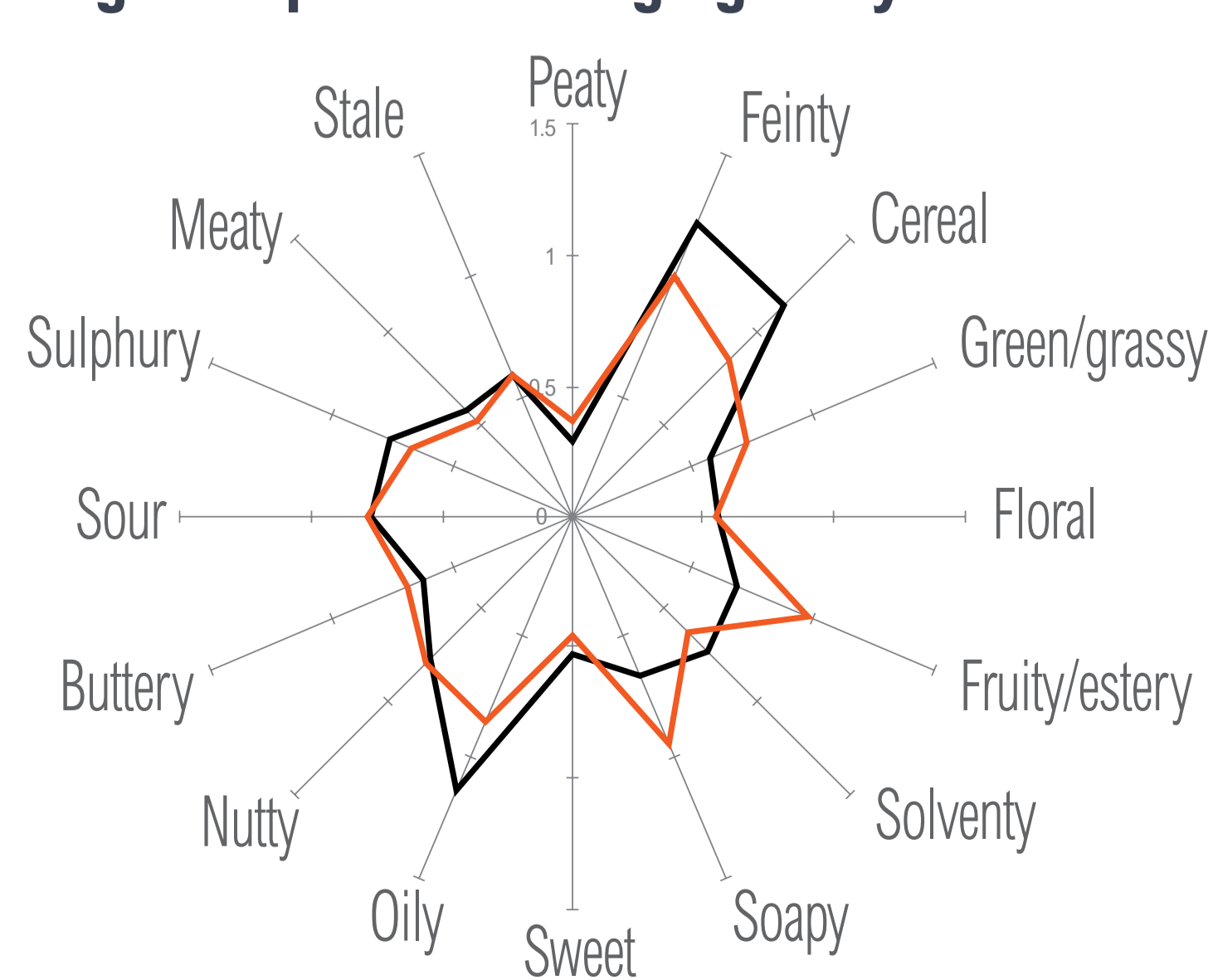
Both yeasts produced profiles consistent with Scotch whisky new make spirit but the balance of aromas varied depending on yeast strain and fermentation conditions. In general, Pinnacle MG+ also produces new make spirit that is considered typical of Scotch whisky new make spirit, with a tendency towards a lighter more fruity/estery character than that produced with the current Pinnacle strain.

High temperature / Standard gravity



— Pinnacle, OG 1060° — MG+, OG 1060°

High temperature / High gravity



— Pinnacle, OG 1080° — MG+, OG 1080°

Summary

Pinnacle MG+ is a promising new strain that shows great potential for the distilling industry. It not only produces good alcohol yields but demonstrates greater stress tolerance to the adverse conditions of high gravity and high temperature.

Pinnacle MG+ also produces new make spirit that is considered typical of Scotch whisky new make spirit, producing flavour profiles that are described as light and fruity/estery in character. MG+ can therefore offer Scotch whisky producers the opportunity to create attractive alternative flavour profiles for new products.