



Scotch Whisky Cereals Technical Note

6th Edition: August 2021

Scotch Whisky Cereals Technical Note



Published by:

The Scotch Whisky Association,
Quartermile Two
2 Lister Square
Edinburgh EH3 9GL

E-mail: agalbraith@swa.org.uk

1st edition: January 2017

2nd edition: August 2017

3rd edition: August 2018

4th edition: August 2019

5th edition: August 2020

6th edition: August 2021

The text of the guidance has been drawn up by the Scotch Whisky Association and its Cereals Working Group.

Disclaimer

This Technical Note has been provided as a document for information purposes only. It is aimed at those wishing to increase their knowledge of Scotch Whisky cereals. Decisions on procurement and the specification of cereals are ultimately a commercial matter for individual companies.

The information contained in the guidance is correct at the time of going to print.

© THE SCOTCH WHISKY ASSOCIATION

Scotch Whisky Cereals Technical Note

	Page
CONTENTS	
Executive Summary	3
Introduction	3
Covid-19	3
Raw materials	4
Environmental sustainability	6
Assurance schemes	7
Commercial issues	8
Barley	11
Pot still distilling malt	11
Moisture content	13
Grain size, screenings, and admixture	14
Grain damage	14
Viability	14
Nitrogen	14
Attributes for malt distilling barley	14
Grain distilling malt	16
Attributes for grain distilling barley	17
Development of new barley varieties	17
Research	17
Barley selection & testing	18
Spring barley varieties suitable for distilling	21
Wheat	23
Wheat varieties suitable for distilling	25
Attributes for distilling wheat varieties	29
Other Cereals	30
Appendix 1 – General Scotch Whisky facts	31
Appendix 2 – Sources of information	34
Appendix 3 – Glossary of terms	36

EXECUTIVE SUMMARY

The Scotch Whisky Association's (SWA) membership accounts for the majority of Scotch Whisky production. Our aim is to create conditions for long-term growth worldwide and secure Scotch Whisky's place as the leading high-quality spirit drink. We hold regular meetings with a range of stakeholders, including the Agriculture & Horticulture Development Board (AHDB) Cereals & Oilseeds, the Maltsters' Association of Great Britain (MAGB), and the National Farmers Union of Scotland (NFUS), to share views on industry and supply matters, the evolving requirements for cereal varieties, industry best practice and policy developments. This close dialogue between the organisations has helped ensure that the Scotch Whisky industry's specific cereal requirements are provided for, preferably in Scotland.

Cereals are a critical raw material for the Scotch Whisky industry. As an industry with long-term sustainability ambitions, the industry must plan ahead with its supply chain to ensure a continuity of quality cereal supplies to maintain and underpin the development and growth of its products. Strong collaboration among the industry and its supply chain is essential so that everyone from growers to grain merchants to distillers, receive a clear message regarding the strategic needs of the growing Scotch Whisky industry.

The SWA works closely with its key stakeholders and the purpose of this generic document is to help achieve a common understanding of the importance and use of cereals within the industry. Those working within the supply chain and the industry wishing to increase their knowledge of Scotch Whisky cereals may also find it of interest.

It is important to note that decisions on procurement and the specification of cereals are ultimately a commercial matter for individual companies.

This is the sixth edition of the Cereals Technical Note.

Introduction

COVID-19

During the COVID-19 lockdown period, Scotch Whisky companies significantly scaled back operations to protect the safety of its workforce. Now that restrictions are easing, sites are back in full production. Global exports of Scotch Whisky fell by more than £1.1bn during 2020, according to figures released by the Scotch Whisky Association (SWA). The export figures are the lowest they have been in a decade, as the combined impact of Covid-19 and the 25% tariff in the United States hit distillers hard. In 2020, the export value of Scotch Whisky exports fell 23% by value to £3.8bn. The number of 70cl bottles exported fell by 13% to the equivalent of 1.14bn.

The value and volume of exports to most of Scotch Whisky's top 10 markets fell as countries went into lockdown to combat the spread of Covid-19 during 2020. The closure of hospitality and travel restrictions impacting airport retail globally saw export values fall in 70% of Scotch Whisky's global markets compared to 2019. Exports to the EU 27, the industry's largest regional export market, fell by 15%.

Scotch Whisky Cereals Technical Note

However, as the UK moves into recovery, the industry will work hard to regain its strength in markets globally as countries continue to lift restrictions put in place to slow the spread of Covid-19. In doing so, it will be critical to have the support of government in keeping trade flowing. Throughout the crisis, we have continued to meet (remotely) and communicate with key stakeholders, highlighting the importance of a fully operational distilling sector to Scottish agriculture.

Raw Materials

The Scotch Whisky industry relies on a sustainable and plentiful supply of good quality cereals. Seed producers, farmers, grain merchants and maltsters are all critical to the industry's success. A strong and well-functioning supply chain is therefore crucial.

By law, Scotch Whisky must be distilled and matured in Scotland using only three raw materials – cereals, water, and yeast¹. Scotch Malt Whisky must use 100% malted barley and be distilled in a pot still. Grain Scotch Whisky is normally made from unmalted cereals (usually soft winter wheat or maize) with the addition of around 10% 'high DP (Diastatic Power)' malted barley and is typically distilled in a continuous column (patent) still. 'High DP' barley will normally exceed 1.80% nitrogen to achieve the required level of enzyme activity for conversion of the whole mash to fermentable sugars. Grain Whisky is mostly commonly used as a component part of blended Scotch Whisky, which accounts for around 90% of all Scotch Whisky sales. Distillers normally obtain their malted barley supplies under contract from commercial sales maltsters.

The reputation of Scotch Whisky is established on traditional methods and that the production process takes place in Scotland, rather than the origin of our raw materials. There has never been a requirement to use Scottish only cereals in Scotch Whisky. The industry is, however, supportive of Scottish agriculture and in 2019, SAOS estimates that 93% of Spring barley processed at distilleries was from Scottish sources (approximately 53% of the total Scottish Spring barley crop). Averaged over the past 3 years, the figure equates to approximately 86% of distillers' requirements². There are currently 134 operating distilleries and at the time of writing there are plans for around several more. Growing the industry will support a bigger cereals requirement, which is good news for the whole supply chain.

Globally, barley is the fourth largest cereal crop. In 2020, there was a 41% increase in the production of spring barley in the UK (6.3 million tonnes). This was caused by a 54% increase in the area from 710 thousand hectares in 2019 to 1.1 million hectares in 2020. This offset a decrease in the spring barley yield, from 6.3 tonnes per hectare in 2019 to 5.8 tonnes per hectare in 2020³. The large number of growers switching from winter wheat to spring barley meant that, despite the difficult season, barley production in 2020 was up slightly on the record harvests seen in 2019. The price of barley fell by 2.1%, due to plentiful supplies and lower demand from brewers because of hospitality venues being closed during Covid-19 lockdowns⁴. In 2020, spring barley accounted for 55% of Scotland's cereal growing area (258,702 hectares). This compares with 48% of Scotland's cereal growing area (242,090 hectares) in 2019. Yield was up to 6.85 tonnes per hectare (compared

¹ Scotch Whisky Regulations 2009

² SWA Summary of SAOS Report on Cereals Provenance (May 2021) – available to SWA members only

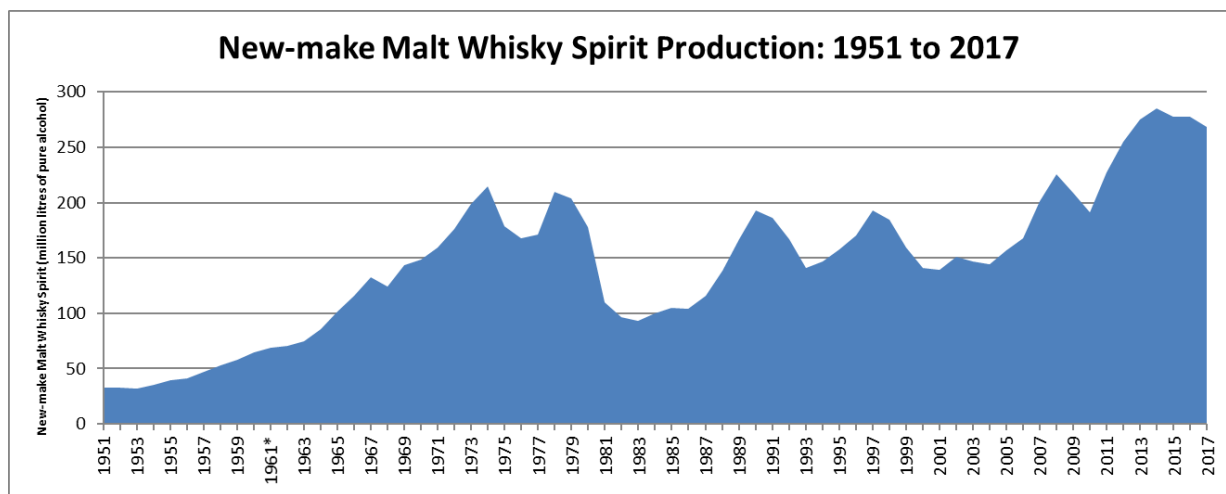
³ Defra - Farming Statistics – provisional arable crop areas, yields and livestock populations at 1 June 2020 United Kingdom (8 October 2020)

⁴ Defra – Total Income from Farming in the United Kingdom – First Estimate 2020

Scotch Whisky Cereals Technical Note

with 6.38 tonnes per hectare in 2019). Barley production was up by 15% (1.7m tonnes compared with 1.5m tonnes in 2019) – about half is used for the drinks industry, with most of the rest used for animal feed⁵. The Scottish climate lends itself to quality barley production and that combined with good agronomic practice barley knowledge makes Scottish barley (all other things being equal) very attractive to distillers. Due to recent expansion, the Scotch Whisky industry is now the largest end-user of malting barley in the UK⁶.

Past production of new-make Scotch Whisky spirit is characterised by a cyclical pattern which is underpinned by underlying growth. We are unable to publish recent production figures for combined grain & malt new make spirit due to competition law.



[Scotch Whisky Association]⁷

The UK distilling industry uses between 700,000 and 800,000 tonnes of wheat each year amounting to approximately 5% of the total UK wheat production⁸. Grain distillers usually source soft textured feed wheat, although some biscuit making varieties are also suitable.

The SWA cannot offer predictions of distillers' requirements for future cereals based on export figures. Sharing production projections would infringe competition law.

While the information in this Technical Note may be of interest to the supply chain, it is ultimately a commercial decision of individual Scotch Whisky companies which varieties or technical specifications they wish to apply when procuring cereals to produce their spirit.

⁵ Scottish Government - Cereal and oilseed rape harvest: final estimates 2020

⁶ Maltsters' Association of Great Britain

⁷ Scotch Whisky Association

⁸ Whisky Technology, Production and Marketing 2nd edition (2014) – James Brosnan & Tom A. Bringhurst

Environmental Sustainability

The Scotch Whisky industry, supported by the SWA, has adopted a new comprehensive Sustainability Strategy⁹ with a view to reducing progressively the impact Scotch Whisky companies and their supply chains have on the environment. The new Strategy, launched in January 2021, builds on the previous Environmental Strategy which started in 2009.

The Strategy provides a pathway defined by four themes – climate change, responsible water use, transition to a circular economy and sustainable land use. Cereals, and particularly barley, are at the heart of Scotch Whisky production. The industry therefore deeply cares about sustainable cereals production to safeguard its future growth. We understand the challenges the farming industry faces – agriculture is a major source of greenhouse gases. We want to assist in finding sustainable solutions. The industry pledges to work collaboratively with the cereals value chain to develop Net Zero Barley by 2045. We are developing a suite of activities and measures which together aim to achieve ‘Net Zero’. We will do that collaboratively with key stakeholders in the farming and malting sectors and through a multi-disciplinary approach with the involvement of the International Barley Hub.

The Scotch Whisky industry wishes to encourage the development of cereal varieties which can demonstrate a reduced carbon footprint (e.g., by decreased requirement for fertiliser or pesticide inputs). Similarly, the industry welcomes varieties which offer a more robust profile to climate change predictions suitable to Northern Britain. This would improve the tolerance to extreme weather conditions, such as periods of drought or heavy rainfall, which are predicted to become more common in future years.

In 2019, the Scotch Whisky Research Institute commissioned the James Hutton Institute to carry out research into projected climate change effects on growing malting barley in Scotland. Using advanced climate modelling techniques on a data set of over 27,000 unique soil and weather combinations both temporal and spatial projections were made on barley growing until the year 2090. Whilst inevitably there are both assumptions and uncertainties in research findings, the research provided a clear demonstration of climate effects. There is some reassurance from the study that barley yields are likely to remain on average viable in Scotland – with even possible gains under some scenarios. However, more frequent extreme weather variations will provide individual harvest challenges and other barley growing areas outside Scotland are likely to be severely compromised. This research has reinforced the need to engage with the supply chain to ensure the sustainability of barley supply.

⁹ Scotch Whisky Association Sustainability Strategy

Scotch Whisky Cereals Technical Note

Supply chain engagement is key.

The industry seeks to source from Scottish and UK cereals wherever possible.

The quality and sustainability of our cereal supplies is crucial.

The industry prefers particular characteristics in its supplies. Some companies actively seeking varieties that have a lower impact on the environment.

Assurance Schemes

Suppliers of cereals to the Scotch Whisky industry will wish to check with their customers which, if any, assurance schemes they should use. In the UK, food assurance schemes help to provide consumers and businesses with guarantees that food has been produced to particular standards. These schemes are mainly voluntary arrangements, although many food businesses make certification in an assurance scheme a specification requirement for their suppliers. The Food Standards Agency (FSA) maintains close contact with assurance schemes because of their potential to promote farm practices that contribute to recommended policy. They also monitor whether communications and claims made by assurance schemes are accurate.

The FSA advises that imports of cereals from countries outside the European Union (EU) must meet the same or equivalent food hygiene and compositional standards and procedures as food produced in the UK or other EU Member States. A health certificate is not normally required to import these products¹⁰.

Scottish Quality Crops (SQC) standards¹¹ (as set out in the SQC Manual) are designed to provide all levels of the cereal supply chain and consumers with an assurance from the grower that the highest production standards, food safety and environmental care have been achieved. Cereals produced under the SQC assurance scheme are used with the knowledge that external, independent audits ensure compliance with the standards. Maltsters and distillers are aware that the cereals grown within the SQC scheme come from farms with a good standard of crop management, are of high quality and traceable.

The SQC scheme is dynamic and will alter in response to consumer, customer, and legislative demands. In recognition of this, the Scotch Whisky industry will continue to play an active role in the development of all aspects of SQC, especially in cereal traceability, on-farm HACCP (Hazard Analysis and Critical Control Points) and food safety procedures. The procurement of home-grown, sustainable, high-quality cereals remains a priority for the Scotch Whisky industry. SQC's Combinable Crop Assurance Scheme Standards have recently been awarded SAI Global Assurance Silver Status. The SQC Scheme undertook a full review of its Standards during 2019 and SQC introduced on farm sustainability areas within its standards including Biodiversity measures.

¹⁰ Food Standards Agency

¹¹ Scottish Quality Crops

Scotch Whisky Cereals Technical Note

*Red Tractor*¹² has grown to become the UK's biggest farm and food standards scheme, covering all of animal welfare, food safety, traceability, and environmental protection. It sets robust standards of good agricultural practice to ensure safe food, protection from pollution and, for livestock, animal health and welfare. Farms and food companies are checked regularly to ensure they meet the requirements.

Assurance Schemes - Alongside the legislation that covers food production from farm to fork, assurance schemes are voluntary arrangements that guarantee conformity of production to set standards. In addition, assurance scheme bodies can work with regulatory bodies to help implement relevant policies. Various schemes exist for different types of foods and address different concerns, but they provide independent assessment that is designed to reassure the consumer and build trust.

Assured UK Malt¹³ is a scheme operated by the MAGB. It brings together various aspects of new and existing codes of practice making up a set of standards which are unique in the world of malting. For brewers and distillers purchasing malt bearing the AUKM mark of certification, the scheme offers reassurance about traceability and quality. Companies which use the Assured UK Malt mark of certification (which is independently verified and audited) must reach the prescribed standards in the following areas:

- Compliance with MAGB HACCP (Hazard Analysis Critical Control Point) Guide;
- Use only assured grain from recognised and externally audited cereals assurance schemes;
- Traceability of grain from its sources to bulk storage, and from there to delivered malt;
- Have in place effective and well documented quality management systems;
- Full compliance with all food safety legislation and due diligence in fulfilling these obligations.

UKAS¹⁴ accredits a range of laboratories, certification and inspection bodies, proficiency testing and reference material providers working within the food industry, covering all aspects of the food supply chain from farm to fork. Being a UKAS accredited body demonstrates that the right rigorous processes are in place, which are performed by fully qualified and trained auditors.

TASCC¹⁵ (Trade Assurance Scheme for Combinable Crops) is the Quality Assurance scheme that joins up SQC with Assured Malt. TASCC was developed because farmers and end users wanted to be sure that crops of grain, oilseeds and pulses were treated responsibly once they left the farm. That includes wheat processed by flour millers and malting barley for the brewers and distillers in the drinks industry. It provides independent verification that the trade is meeting food safety laws. It covers all merchant activity including transport, drying and storage, grain analysis, merchant trading & administration etc.

Commercial Issues

Individual Scotch Whisky producers will have their own specific procurement policies and practices with which suppliers will wish to familiarise themselves if they wish to supply to those companies. Each company policy will reflect the needs of individual Scotch Whisky brands and they may vary from company to company. It would be against UK competition law for the SWA to take positions

¹² Red Tractor

¹³ Assured UK Malt Scheme

¹⁴ UKAS

¹⁵ TASCC

Scotch Whisky Cereals Technical Note

that would influence companies' procurement decisions. For that reason, the Association remains neutral on issues such as the use of genetically modified (GM) cereals or the use of biosolids (sewage sludge) on land used to grow cereals. We are not, however, aware of any company using genetically modified (GM) cereals.

Biofertilisers: There are environmental benefits to using quality biofertilisers on agricultural land. Biofertilisers are a good source of readily available nitrogen, phosphate, potash, sulphur, and trace elements. They are also a source of organic matter. Farmers and growers can save on manufactured fertiliser costs by using locally available biofertilisers which are produced from recycled materials, with its use completing natural nutrient and carbon cycles. However, despite the sustainability benefits, farmers should always liaise with their customer before using the material. Different distillers take a range of views on the use of biofertilisers.

Anaerobic Digestion (AD) plants can produce valuable renewable energy and fertiliser resources. The public body WRAP (Waste Resources Action Plan) has developed the publicly available specification (PAS) BSI PAS 110 which aims to help remove the major barrier to the development of AD and its markets for digestion process outputs by creating an industry specification against which producers can verify that they are of consistent quality and fit for purpose. There is also a standard for compost which is British Standards Institution's (BSI) PAS 100¹⁶. The use of sewage sludge supernatant liquids is not permitted under either BSI PAS110 or BSI PAS100. The SWA takes a neutral position on the use of PAS110 / PAS100 materials and procurement decisions are solely for individual companies.

Scotch Whisky brands reputation is based on industry-wide good environmental practice and also our reputation as advocates of environmental leadership. These green ambitions need to be reflected across all of our policy positions. As the sector invests in AD (Anaerobic Digestion) technology to deliver on its renewable energy target, in parallel we must also consider how to improve the acceptability of the associated distillery digestate for use on agricultural landbanks. As part of this we will also consider future landbank availability as well as improving our understanding on how the wider cereal supply chain values this material.

In consultation with the SWA and other key stakeholders (including SEPA), SQC has developed an AD Digestate Scheme standard¹⁷. SQC recognises the requirement for agriculture and associated industries to embrace high quality digestate through on-farm AD operations. Containing only processed 'green' farm grown products and brewing/distilling materials, the digestate produced is a useful fertiliser and soil improver and, incorporating it into the soil, is good farming practice. The aim of the SQC Farm Approved Digestate Standards is to define acceptable inputs to the AD plant, best practice, and conditions to allow the application of SQC Approved Digestate onto land destined for cereal production. Applications for the standard are open to producers with on-farm anaerobic digester plants. The scheme operates alongside, but independently, of the SQC Farm Assurance Scheme. A separate application will be required for membership of the SQC Approved Digestate Scheme. The audit frequency for the scheme is twice a year. If farm AD operators follow the inputs and directives listed in the standard, the digestate being supplied ex the farm plant should meet the criteria allowing it to carry the Scottish Quality Crops 'Approved Digestate' Mark.

¹⁶ PAS 100

¹⁷ Scottish Quality Crops Approved Digestate Scheme Standards (November 2019)

Scotch Whisky Cereals Technical Note

Fertilisers and Pesticides: Pesticides and other plant protection products used in British agriculture are subject to stringent legislation. In addition to these statutory requirements, plant protection products are subject to a rigorous testing regime to check for any adverse effects on malt quality or other effect on processing before they are accepted for use on malting barley in the UK. The SWA is an active participant on the British Beer & Pub Association (BBPA) Agrochemicals Working Party which reviews and comments on the evaluation reports. The Accepted Agrochemicals List¹⁸, published by BBPA/Campden BRI (Brewing Research International), lists those agrochemicals accepted for use on cereals for malting and brewing and is made available to growers and users of malting barley. For a chemical to be included on the list of accepted agrochemicals, Campden BRI will carry out an initial assessment of factors, including chemical nature, mode of action, time of application and available test data. Following this initial assessment, Campden BRI will conduct any additional malting or brewing trials necessary to come to a decision. These further trials do not replace or duplicate the toxicological or efficacy testing required by the Chemicals Regulation Directorate (CRD) before the chemical can be registered but are designed to test the suitability of treated crops for processing specifically within the malting and brewing industry.

Increasingly, there are challenges around the use of chemicals and pesticides. We guard the reputation of Scotch Whisky carefully and, therefore, the industry takes extreme care in the inputs used from grain to glass. The production process of Scotch Whisky, including multiple distillations, will prevent any residual trace levels of pesticides and other plant protection products being transferred to the final product.

All ag-chem advice, storage and transport is certified under BASIS¹⁹. Fertiliser manufacturers and distributors are quality assured under FIAS²⁰ and fertiliser advice is given by advisors who are FACTS²¹ qualified.

¹⁸ BBPA/Campden BRI Accepted Agrochemicals List for Use on Cereals 2020

¹⁹ BASIS

²⁰ FIAS

²¹ FACTS

BARLEY

Barley is a plant similar to wheat but is hardier, growing well in a cool temperate climate. It is normally germinated and dried to produce malted barley, sometimes called 'malt'. Barley malt is useful for distillers because:

- It can make a significant contribution to the flavour of whisky; and
- It is a good source of enzymes which convert starch to sugar.

Spring barley is typically sown from December until late April²², whereas Winter barley is sown in September and October. The crop is relatively frost-sensitive so early sowing is not common in the North. Spring varieties on the AHDB Cereals & Oilseeds Recommended Lists (see page 18) mature within a narrower period than do two-row Winter barley varieties. As winter barley flowers and matures three to four weeks earlier than the Spring crop, it makes it less susceptible to unfavourable conditions late in the season. The winter crop also has a considerable yield advantage over spring barley, given its longer growing season, and could help provide a more consistent and sustainable supply to maltsters. However, the use of winter barley for malting has been in a steady decline over the last 30 years. This is, in part, due to the better malting quality of modern Spring barley varieties, compared to the winter crop – in terms of hot water extract (HWE), friability and homogeneity. Concerns over the EPH (epiheterodendrin) trait being present in most winter barleys are also a factor, as EPH acts as a precursor to ethyl carbamate during the whisky production process. These factors have brought the use of winter barleys in distilling to negligible amounts. The IMPROMALT project (which concluded a couple of years ago) aimed to improve the malting quality of winter barley in the UK. The breeders involved now have the tools to breed distilling suitable winter barleys (by improving their HWE as well as removing the EPH trait). In the longer term, the re-invigoration of this crop type will help address some of the sustainability concerns of the UK barley crop and adaptation to climate change.

Malting barley users have specific requirements. Key characteristics are variety, germination, nitrogen content and grain size. Most feed grain buyers specify specific weight. Some varieties are prone to splitting and skinning which may lead to rejection by maltsters.

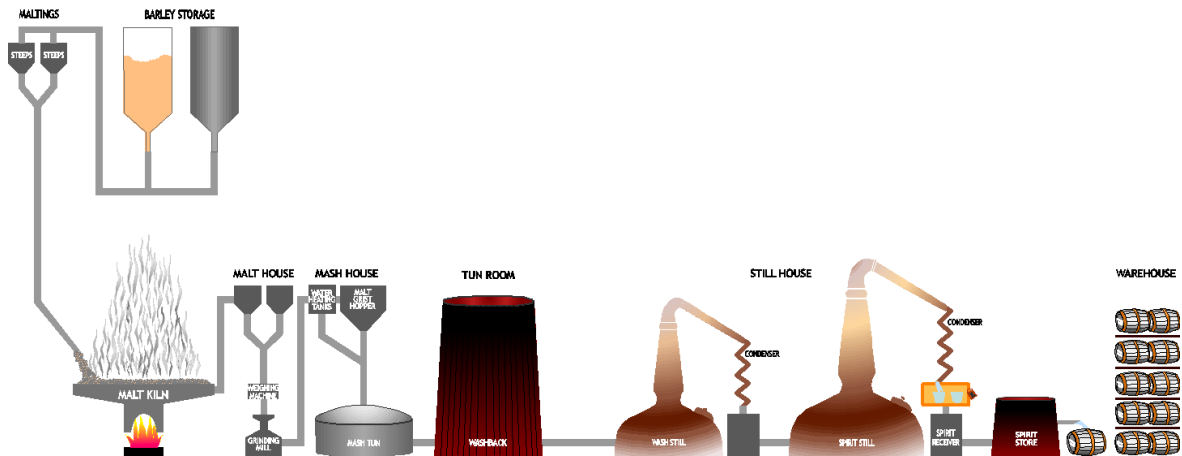
Preferred barley varieties are those with high alcohol yield and consistent processing, those that produce no undesirable by-products during distillation and those with high enzymes for grain distilling malt.

Pot Still Distilling Malt

In malt (pot still) Scotch Whisky production, malted Spring barley is the only cereal used. The barley provides all of the carbohydrate and enzymes for the conversion of the starch to sugars. The main objective is that the malt contains the highest possible fermentable extract which leads to the highest possible spirit yield, measured in litres of pure alcohol per tonne of malt used. This is why the parameters for barley are so important.

²² AHDB Cereals & Oilseeds Barley Growth Guide

Scotch Whisky Cereals Technical Note



Barley for pot still distilling requires a high starch content (hence lower protein and higher spirit yield). A nitrogen level of less than 1.60% in the barley is considered optimum and will be the maltsters' target if the crop quality allows.

Distillers and maltsters agree on malt specifications on an individual basis and are subject to change as a result of commercial trading issues, availability, and harvest quality. Thus, it is not possible to be absolutely specific regarding all the parameters that are included.

Medium Priority

Good & uniform corn size

Good husk appearance

Ripens evenly

Low dormancy

No pre-germination

High Priority

Resistance to splitting at any stage

Mealy, not steely, endosperm

Rapid, even water uptake (hydration)

The quality of low nitrogen pick-up when growing

Vigorous germination

High starch content

Non-glycosidic nitrile potential

Scotch Whisky Cereals Technical Note

The following is a generic example of a typical Pot Still Distilling Malt specification for an average harvest year²³. **Please note - this is company dependent.**

Parameter	
Moisture	4.5%
Extract (0.7mm), as is	77.5 %
Fermentability	87.0 %
Fermentable Extract	67.5 %
Predicted Spirit Yield	410 L / tonne
Total Nitrogen / Protein, dm	1.5 %
Soluble Nitrogen Ratio (SNR)	35.0 – 42.0 %
Glycosidic Nitrile (GN)	Non-producing variety

The Scotch Whisky industry is appreciative of growers' efforts to support non-Glycosidic Nitrile (GN) varieties. This has helped the industry to significantly reduce the potential for ethyl carbamate formation. The industry attaches increasing priority to the ethyl carbamate issue because of the gradually tightening regulatory focus. This demonstrates the industry's commitment to the progressive reduction, and long-term elimination, of GN in barley varieties used for malting.

Moisture content

Moist grain stored for any length of time can become contaminated with toxins from moulds, which can render grain unsaleable. Without great care, drying can ruin malting potential. It is impossible to give accurate drying temperature guidelines to cover all situations: variety, initial moisture content, type of dryer, throughput speed and/or dwell time etc. Many merchants and maltsters recommend that raised temperature drying is left to their professional skills²⁴.

Above 14% moisture content, grain cannot be safely stored. UK maltsters usually dry to 12% for long-term storage.

²³ Scotch Whisky Association Cereals Working Group

²⁴ AHDB Grain storage guide for cereals and oilseeds (Third edition)

Scotch Whisky Cereals Technical Note

Grain size, screenings, and admixture

Barley is screened before processing to remove undersized grains and impurities, e.g., chaff and weed seeds, which must be removed before malting. Small or under-sized grains will not process properly, so a maximum figure is specified by the buyer. Undersized grains and impurities are measured using standard slotted sieves of 2.5 mm and 2.25 mm. Admixture is a contamination (e.g., stones, dirt, and foreign bodies) and a buyer typically allows a 2% maximum. The grain buyer will define the standard required in the grain contract.

Grain damage

Kernels damaged by skinning or splitting, for example, will allow nutrients to leak out during malting. This encourages infection and leads to poor extract yields. Skinning can lead to malting barley being rejected. Varietal differences and weather conditions are likely to be key factors. SRUC (Scotland's Rural College) is undertaking research on a range of likely contributing factors²⁵. Combine harvesters can also be adjusted to reduce the percentage of skinned and broken kernels. Excessive high cylinder speeds should be avoided. Insect damage will impair both viability and extract yield. It also encourages mould infection during storage.

Viability

Malting depends on grain germinating under controlled conditions, so grain must be fully viable. The threshold viability for acceptance by maltsters is a minimum of 98% germination. Grain that fails to germinate does not produce enzymes during malting. The resultant malt may cause processing problems in the distillery. Pre-germinated grains can die during steeping (the first stage of malting) or lead to mould growth in malting, both of which can cause problems in the distillery.

Nitrogen

Excessive nitrogen content can impair processing in maltings and distilleries. Nitrogen in the form of protein replaces starch within grain and reduces alcohol yield. However, some protein is necessary for yeast growth during distillery fermentation.

Attributes for malt distilling barley

The SWA has agreed desirable attributes for malt and grain distilling barley. These preferences include varieties which produce high alcohol yield, easy and consistent processing, no glycosidic nitrile (GN) and high enzymes for grain distilling malts. Two-row Spring malting barley with vigorous and even germination, is selected for the production of distilling malt.

²⁵ AHDB Cereals & Oilseeds Grain Skinning

Scotch Whisky Cereals Technical Note

Attribute	Measure	Control
<p>Process Efficiency</p> <p>Maximum alcohol yield potential</p>	<p>Predicted Spirit Yield (PSY), Fermentability, Hot Water Extract (HWE)</p>	<p>Best currently available</p>
<p>Ease of processing in the distillery</p> <p>Cell wall modification</p> <p>Protein modification</p>	<p>Friability (homogeneity) Low wort viscosity β-glucans</p> <p>Total Soluble Nitrogen (TSN) Soluble Nitrogen Ratio (SNR) Free Amino Nitrogen (FAN)</p>	<p>Best currently available</p> <p>Best currently available</p>
<p>Product Integrity/Regulatory Issues</p> <p>Minimise ethyl carbamate precursors</p>	<p>Glycosidic Nitrile (GN) Screen for EPH non-producers</p>	<p>Support only EPH non-producing varieties</p>
<p>Sustainability</p> <p>Identify varieties likely to be resilient to predicted effects of Climate Change and to contribute to lowering the carbon footprint of distilling.</p>	<p>Improved agronomic characters relevant to climate change, improved resistance to pests and diseases, and reduced or improved use of fertiliser or pesticides</p>	<p>Support improvements to established distilling control varieties</p>

Scotch Whisky Cereals Technical Note

Patent Still for Grain Distilling Malt

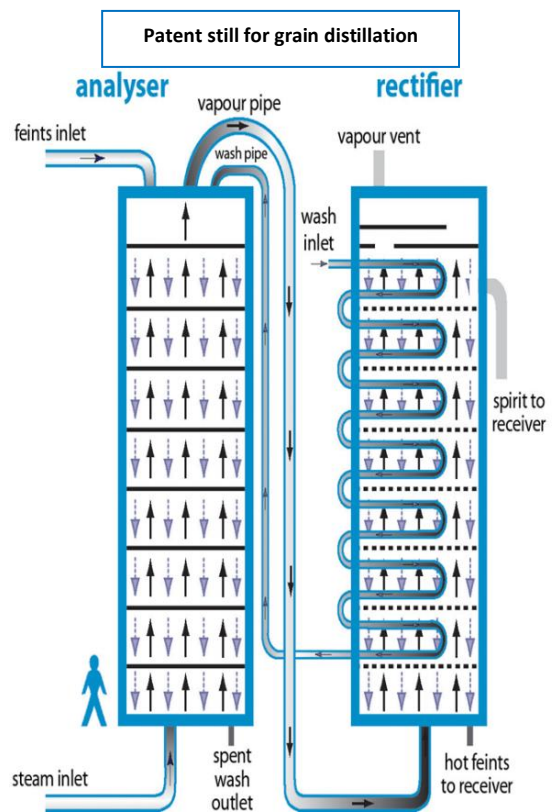
In grain Scotch Whisky production, other unmalted cereals (generally wheat or maize) are used as sources of carbohydrate (starch) with malted barley providing some carbohydrate and all of the enzymes. A main objective is that the malted barley used contains the maximum obtainable amount of the enzymes needed to convert the whole mash to fermentable sugars. Barley with high nitrogen content (High Diastatic Power (DP)) is therefore preferred in the grain distilling process.

Soft wheat varieties have higher starch content than the hard wheat varieties and so have higher yields per tonne of grain used. The 'local' availability of good quality distilling wheat and its relative cost continue to make this cereal attractive to distillers as a raw material.

To achieve the required level of enzyme activity in grain distilling the barley nitrogen will normally exceed 1.80% as the nitrogen component contains much of the latent protein enzyme in the form of beta-amylase. Only varieties that are designated as non-producers of glycosidic nitrile (GN) are selected, ensuring that ethyl carbamate (EC) levels in the final spirit are within current (and potential future) food safety limits.

The following is a generic example of a typical HDP malt specification²⁶ for an average harvest year²⁷.
Please note - this is company dependent.

Parameter	
Moisture	6.5%
Diastatic Power	160 °IOB
Alpha Amylase Activity, dm	60 DU
Free Amino-nitrogen (FAN) 1040	180 mg/l
Glycosidic Nitrile (GN)	Non-producing variety



²⁶ Scotch Whisky Association Cereals Working Group

²⁷ Scotch Whisky Association Cereals Working Group

Scotch Whisky Cereals Technical Note

Attributes for grain distilling barley²⁸

Attribute	Measure	Control
Process Efficiency		
Potential to convert starch to fermentable sugars	Diastatic Power (DP)/ Dextrinising Units (DU)	Best currently available
Protein modification (potential for protein degradation)	Total Soluble Nitrogen (TSN) Soluble Nitrogen Ratio (SNR)	Best currently available Best currently available
Product Integrity/Regulatory Issues		
Minimise ethyl carbamate precursors	Glycosidic Nitrile (GN) Screen for epiheterodendrin (EPH) non-producers	Support only EPH non-producers
Sustainability		
Identify varieties likely to be resilient to predicted effects of Climate Change and to contribute to lowering the carbon footprint of distilling	Improved agronomic characters relevant to climate change, improved resistance to pests and diseases, and reduced or improved use of fertiliser or pesticides	Support improvements to established distilling control varieties

Development of new barley varieties

Research

The barley supply chain has a shared interest in research: namely, to support the agronomy and quality of the UK barley crop. Barley is a critical raw material for the Scotch Whisky industry. As an industry with long-term sustainability ambitions, looking far into the future on consumer and technical trends, a strong research and innovation base underpinning Scotch Whisky critical raw materials is vital. Future opportunity for growth in Scotch Whisky relies absolutely on a sustainable and plentiful supply of UK malting barley.

The Scotch Whisky industry already invests significantly in cereals development via direct research projects, mainly through SWRI²⁹. The majority of SWRI's distilling cereal related research is carried out in collaboration with other scientists in academia or industry, e.g., plant breeders and agronomists. Projects relevant to distilling have included research on malt processability, barley skinning, malting enzyme development, barley disease resistance and effects of barley variety and environment on spirit character in addition to the climate change study discussed above.

²⁸ Scotch Whisky Association

²⁹ Scotch Whisky Research Institute

Scotch Whisky Cereals Technical Note

In addition, individual distilling companies carry out laboratory assessments and distillery trialling of new barley varieties through the Malting Barley Committee alongside brewers and maltsters. All these activities demonstrate the value of coordination of research and supply chain engagement which will be at the core of the International Barley Hub as it tackles the wider challenges of barley sustainability.

The International Barley Hub (IBH) is a major £38 million investment in barley science by UK and Scottish governments under the Tay Cities Deal. This will involve a state-of-the-art laboratory building to be sited at the James Hutton Institute near Dundee, which is already a centre of plant science excellence. While this ambitious project takes shape physically, the IBH is seeking to engage with the barley research community and whole barley supply chain to create a virtual centre for collaboration, information-sharing and cross-fertilisation of ideas and activities to generate significant scientific progress in barley science³⁰. A flagship objective of the Hub, that aligns closely to the needs of the whisky industry, is exploring how to deliver net zero barley. The Scotch Whisky industry through SWRI and SWA has supported the creation of the IBH and looks forward to the opportunities it will provide to underpin the security of our vital barley supply chain.

Barley Selection & Testing

There are well-established systems for the breeding and selection of modern malting barley varieties with input from the entire supply chain. Barley breeding is carried out by commercial plant breeding companies using classical crossing techniques to produce a range of new varieties each year. The process of selection and testing of new varieties is both time-consuming and expensive and each new variety requires up to 15 years development. The development time includes the initial selection and testing of each variety by the plant breeder (9 to 11 years) followed by several years of external National Listing (NL) trials. Each new variety entering the UK assessment system represents an investment by the breeder of around £1m.

Distillers and agronomists have generally acknowledged that there is a shortage of new high-nitrogen grain distilling barley varieties reaching the market. One of the reasons for this is that the demand is very small compared to the overall barley market. Recent research at SWRI, SRUC (Scotland's Rural College) and JHI (James Hutton Institute) has identified specific markers for High DP (Diastatic Power) malt to help plant breeders produce a greater number of these varieties in the future³¹.

When a new variety is put on the market, it will have been assessed on its agronomic merit and end user potential and rated on the AHDB, SRUC and Malting Barley Committee approved lists. The initial 2-year period of testing (NL1 and NL2) is currently managed by the AHDB Cereals & Oilseeds and assesses whether the new variety is suitable for cultivation and use. The Recommended List³² system takes the testing of new varieties a step further, looking to establish through a third year of testing and in collaboration with end-users, whether the new variety has a balance of features likely to give an economic benefit to the industry.

There are several reasons why a variety may be removed from the Recommended List including:

³⁰ [International Barley Hub](#)

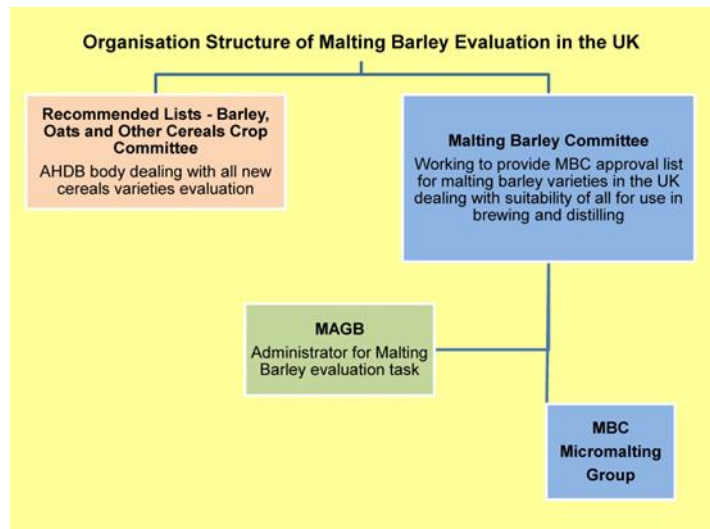
³¹ [AHDB Cereals & Oilseeds Diastatic Power](#)

³² [AHDB Cereals & Oilseeds Recommended Lists](#)

Scotch Whisky Cereals Technical Note

- Agronomic yield is no longer competitive with newer higher yielding varieties;
- Increased susceptibility to disease;
- No longer meets end-user requirements; and
- Insufficient market share (measured by seed area).

The Recommended Lists (published annually in November) are important to distillers although there is no requirement to use them exclusively.



[Reference: Maltsters' Association of Great Britain]

A closely related set of parallel trials is managed by the MAGB, which tests malting barley varieties for brewing and distilling potential³³. The Malting Barley Committee tests small quantities during the two years of National List trials and the first year of Recommended List trials. Results from these tests are used to give a variety a provisional rating with full approval being granted only after successful full commercial testing of larger quantities. If a candidate variety fails to achieve approval, it may be removed from the Recommended List unless its agronomic yield makes it an acceptable feed variety. In reaching their recommendations and decisions for approval, the Malting Barley Committee takes account of the technical assessment of malting quality and wider commercial considerations, such as whether the agronomic performance is sufficiently competitive and how the variety will compare with currently purchased varieties.

The Malting Barley Committee has completed the Spring 2021 round of meetings to evaluate the potential of new malting barley varieties. RGT Asteroid has been removed from the list (Provisional Approval 2) for grain distilling. Tungsten and Firefoxx have been granted Provisional Approval 2 for malt distilling. We advise growers to seek further information from their customers before sowing newly listed varieties. Malting barley varieties recommended by the Malting Barley Committee to be grown for 2022 harvest are as follows:

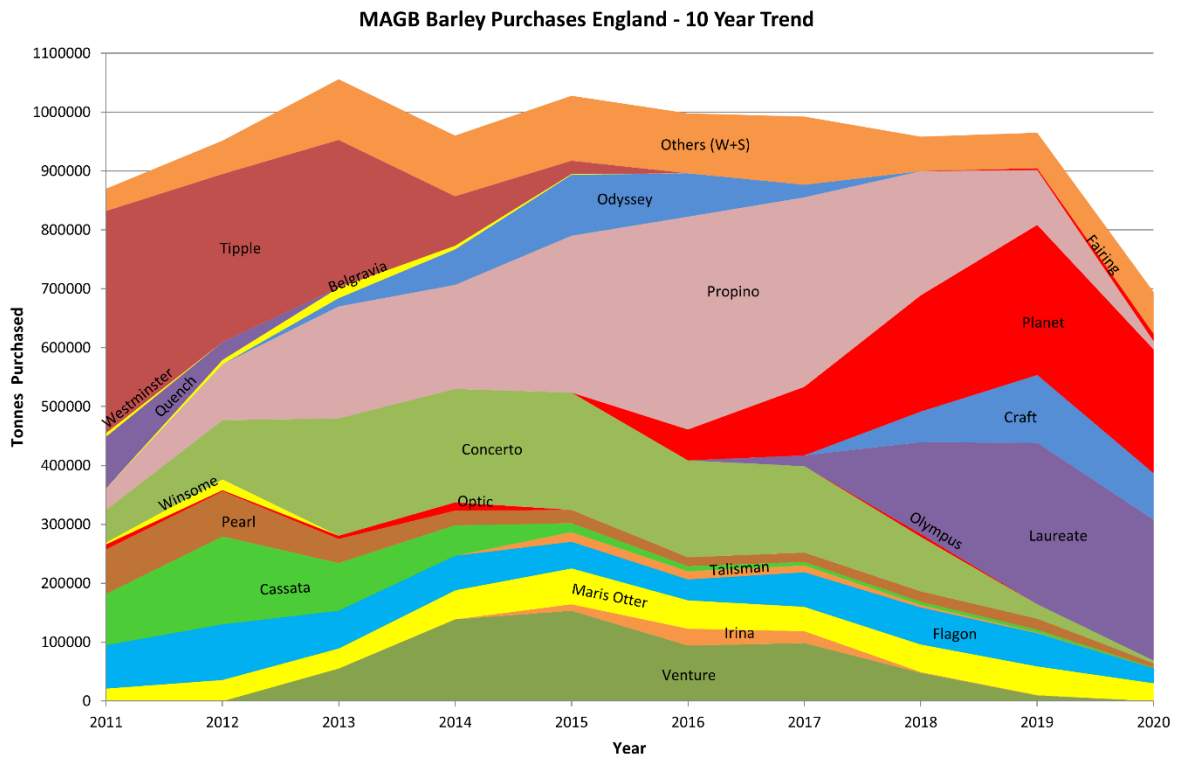
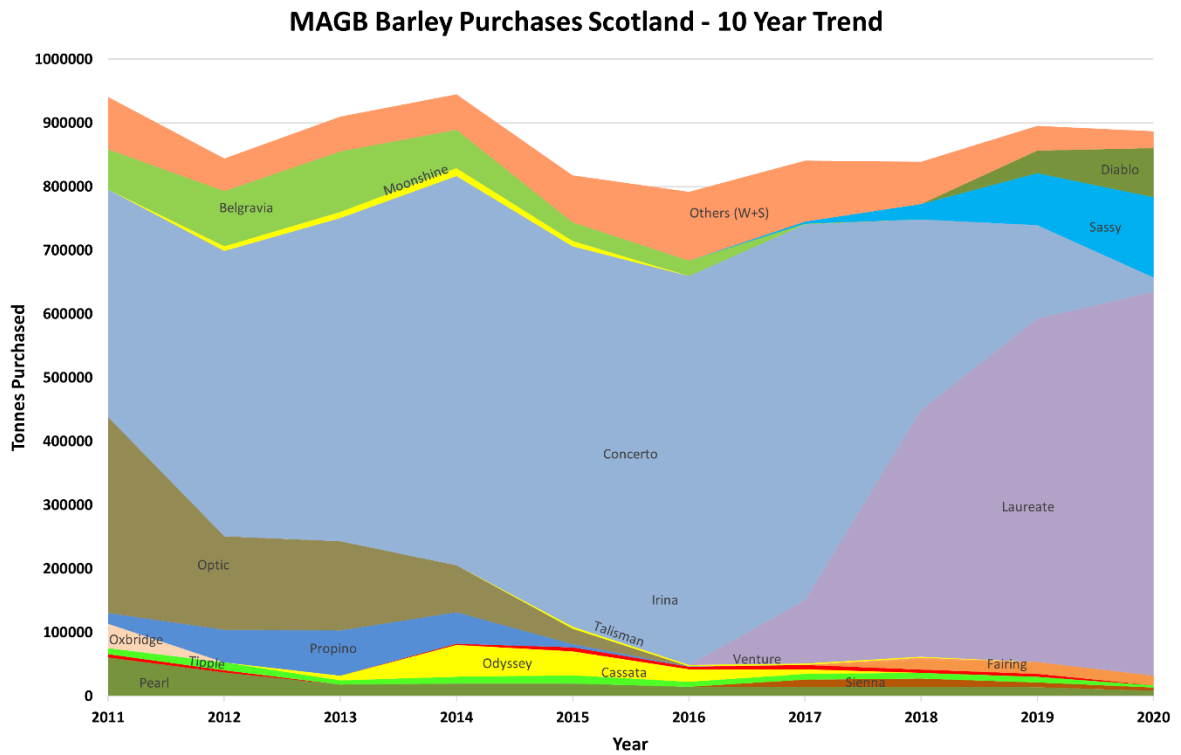
	Spring Varieties for Malt Distilling Use	Spring Varieties for Grain Distilling Use
Full Approval	Laureate LG Diablo KWS Sassy	Fairing

[Reference: Malting Barley Committee]

³³ Malting Barley Committee

Scotch Whisky Cereals Technical Note

MAGB Barley Purchases England and Scotland Combined 10 Year Trend³⁴



³⁴ MAGB

Spring Barley varieties suitable for distilling³⁵

Laureate (Syngenta)

A high yielding variety in both fungicide treated and untreated trials. Laureate has relatively stiff straw and high resistance to brackling and mildew. Laureate continues to hold over 50% of the UK spring barley market.

LG Diablo (Limagrain UK)

A high yielding variety particularly in the North and East regions. It is a later-maturing variety, with relatively stiff straw and high resistance to brackling. It has given good yields in untreated UK trials and has high resistance to mildew. LG Diablo continues to grow its share of the UK spring barley market.

KWS Sassy (KWS)

A very high yielding variety in the North region with moderate resistance to lodging and brackling. It has high resistance to mildew. KWS Sassy continues to grow its share of the UK spring barley market.

Fairing (Syngenta)

A high enzyme variety with Full Approval for grain distilling being awarded by the Malting Barley Committee in 2018 following changes to the approval protocol specific to grain distilling varieties. The variety is early maturing and has high resistance to mildew and rhynchosporium. It is susceptible to brown rust.

³⁵ AHDB Cereals & Oilseeds Recommended Lists 2021/22

Scotch Whisky Cereals Technical Note

AHDB Cereals & Oilseeds Recommended Lists 2021/22 – Distilling Spring Barley Varieties³⁶

		Laureate	LG Diablo	KWS Sassy	Fairing
Quality	Specific weight (kg/hl)	66.3	66.9	68.4	68.2
	Screenings % through 2.25 mm	1.6	1.6	1.2	1.1
	Screenings % through 2.5 mm	3.8	3.9	2.9	2.8
	Nitrogen content (%)	1.51	1.48	[1.51]	-
	Hot water extract (l deg/kg)	314.2	314.1	314.8	[308.2]
Agronomy	Resistance to lodging (no PGR)	7	7	6	7
	Straw height (cm)	70	72	78	72
	Ripening	+1	+2	+1	-1
	Resistance to brackling	8	8	6	8
Disease Resistance	Mildew	9	9	9	8
	Brown rust	5	5	5	4
	Rhynchosporium	6	5	6	6
Breeder		Syn	Lim	KWS	Syn
Annual treated yield (% control)					
	2016 treated (7.8 t/ha)	100	102	98	94
	2017 treated (7.4 t/ha)	100	103	97	92
	2018 treated (6.8 t/ha)	102	102	97	94
	2019 treated (7.8 t/ha)	102	102	98	93
	2020 treated (7.4 t/ha)	102	102	97	92

³⁶ AHDB Cereals & Oilseeds Recommended Lists 2021/22

WHEAT

Distillers have been using white soft Winter wheat as the main starch source for whisky production since 1984. Winter wheat is the highest yielding cereal in Britain and comprises the largest acreage sown. Winter wheat is sown in late September to November and is harvested the following September. Nitrogen applications are carefully controlled during crop growth as nitrogen applied to crops nearer harvest will accumulate in the grain. This will give an increased final nitrogen content which is not favourable in wheat for distilling³⁷.



In the UK, Winter wheat varieties are classified into four groups by the UK Flour Millers³⁸. Groups 1 and 2 hard wheats are targeted at milling and baking end users and are considered unsuitable for distilling. Grain distillers require low-nitrogen, soft Winter wheat varieties, which are easy to process and give good alcohol yields. These are normally classed with biscuit and feed wheat (UK Flour Millers Groups 3 and 4). The wheat is usually milled and heated before cooling to mashing temperature where approximately 10 % of a high enzyme malting barley will be added to convert the solubilized starch to sugars, i.e., the wheat forms 90 % of the total mash bill.

Breeders have successfully produced soft wheat varieties which achieve consistently high alcohol yields and low viscosity levels desired by distillers. The high alcohol yield results from high starch content in the grain and its efficient conversion to fermentable sugars. Given the huge volumes of alcohol produced, even a small relative difference in alcohol yield between varieties represents a potential large loss in spirit to the distiller. Low viscosity will benefit process efficiency in the grain distillery. There are two main areas where viscosity is an issue:

- Cooking - where the wheat starch is gelatinised and other gum like polymers hydrated, potentially causing excessive viscosity, and resulting problems e.g., with pumping;
- When the distillery makes syrup for animal feed by evaporating the liquid residue left after distillation - excess viscosity impairs the efficiency of the evaporator plates leading to deposits requiring cleaning, in effect shutting down the distillery.

As even the best distilling wheats are quite viscous, distillers are seeking the best alcohol yield per tonne processed in the fastest unit time.

³⁷ Whisky Technology, Production and Marketing 2nd edition (2014) – James Brosnan & Tom A. Bringhurst

³⁸ UK Flour Millers

Scotch Whisky Cereals Technical Note

Growers need varieties that will suit their conditions, but they must be conscious about the effect of nitrogen on the grain sample, balancing the needs for high starch with high agronomic yield. Good distilling wheats also have to be agronomically competitive, particularly against the returns found in the feed wheat sector. The distilling industry will want to see more varieties coming through the AHDB system combining high alcohol yield and low viscosity



(while being agronomically competitive) to give growers more choice of variety if they are growing for the distilling market. Wheat varieties are marked on their suitability for distilling on the AHDB Recommended List which is based on analysis of new varieties carried out by the SWRI.

Wheat varieties are marked on their suitability for distilling on the AHDB Recommended List which is based on analysis of new varieties carried out by the SWRI. SWRI tests candidate varieties against control varieties from several sites across the UK to build a picture of how the varieties perform, not just in one site, but many important arable areas. If the candidate cannot meet/beat the performance of the control, then the candidate variety will be seen as a relatively poor distilling variety. To get onto the Recommended List, a candidate variety must meet the performance of control varieties that are already on the list. Acceptable distilling soft wheat varieties are classified by AHDB as Y = Suited to that market, [Y] = May be suited to that market and a dash = a non-suitable variety. The SRUC's Scottish Recommended List classifies samples as Good, Medium, or Poor for distilling.

A basic specification³⁹ for wheat for distilling is:

- Moisture, maximum 15%;
- Total nitrogen less than 2% (for high starch content);
- Specific weight greater than 72kg/hl (also indicating high starch content).

You can find further information on growing wheat in the AHDB Cereals & Oilseeds 'Wheat Growth Guide'⁴⁰.

³⁹ Scotch Whisky Association Cereals Working Group

⁴⁰ AHDB Cereals & Oilseeds Wheat Growth Guide

Scotch Whisky Cereals Technical Note

UK Flour Millers Group 3 wheat varieties suitable for distilling⁴¹

Elicit

A UK Flour Millers Group 3 variety rated 'Good' for distilling. The relatively stiff-strawed variety has produced high treated yields in the North region. It has high resistance to yellow rust and brown rust, combined with resistance to orange wheat blossom midge and above-average resistance to fusarium ear blight. It tends to sprout so should be given priority at harvest.

LG Astronomer

This new relatively stiff-strawed variety has a high specific weight and is rated as 'medium' for distilling. Limited data suggests that it has a very high yield potential in an early sowing situation. It has high resistance to yellow rust and brown rust, combined with resistance to orange wheat blossom midge. It is susceptible to mildew. During testing, it showed slight variability in gluten quality.

LG Illuminate

This new addition is high-yielding and rated 'medium' for distilling. It has performed well across a range of soil types and rotational positions. Limited data suggests that it has a very high yield potential in early sowing situation. It has high resistance to yellow rust, brown rust and septoria tritici, combined with resistance to orange wheat blossom midge. It is a short and relatively stiff-strawed variety.

LG Prince

This new addition is high-yielding and rated 'medium' for distilling. It tends to give a low specific weight. It has performed well across a range of soil types and rotational positions. It is a relatively late-maturing variety. It has high resistance to orange wheat blossom midge and susceptible to mildew. It is a short and relatively stiff-strawed variety.

LG Quasar

This new addition is high-yielding and rated 'medium' for distilling. It tends to give a low specific weight. It is a medium-tall and relatively stiff-strawed variety and has performed well on heavier soils and in a late sowing situation (based on limited data). It has high resistance to brown rust and Septoria tritici, combined with resistance to orange blossom midge.

Merit

This new addition is rated 'medium' for distilling. It has performed well on heavier soils and limited data suggests it has high yield potential in a late sowing situation. It has high resistance to yellow rust, brown rust and Septoria tritici, combined with resistance to orange wheat blossom midge. It is very susceptible to mildew.

⁴¹ AHDB Cereals & Oilseeds Recommended Lists 2021/22

Wheat Group 3 Varieties Suitable for Distilling

	Elicit	LG Astronomer	LG Illuminate	LG Prince	LG Quasar	Merit
Grain quality						
Endosperm texture	Soft	Soft	Soft	Soft	Soft	Soft
Protein content (%)	11.8	11.9	12.0	11.3	11.6	11.7
Hagberg Falling Number	213	238	251	250	212	255
Specific weight (kg/hl)	76.8	77.8	76.6	74.8	75.4	76.5
Chopin alveograph W	90	[134]	84	[74]	87	87
Chopin alveograph P/L	0.3	[0.4]	0.3	[0.3]	0.3	0.2

[Reference: AHDB Cereals & Oilseeds]

UK Flour Millers Group 4 Wheat Varieties Suitable for Distilling⁴²

LG Skyscraper

Recommended for the UK as a soft-milling, very high-yielding feed variety. It is rated as 'Medium' for distilling. LG Skyscraper has given very high treated yields across the UK, particularly in the East and West regions. It has performed well across a range of soil types and rotational positions. This medium-tall variety has high resistance to yellow rust and mildew, as well as resistance to orange wheat blossom midge.

LG Spotlight

Recommended for the UK as a soft-milling, high-yielding feed variety. It has high Hagbergs and a high specific weight. It is rated as 'Medium' for distilling. LG Spotlight has given high UK yields in treated trials and has a very high yield potential in the West region. This medium-tall and relatively stiff-strawed variety has performed particularly well on heavier soils, in a first-cereal situation and early drilling situations. It has high resistance to yellow rust, brown rust, and resistance to orange wheat blossom midge.

LG Sundance

LG Sundance is a high yielding Group 4 soft feed variety for the UK which is suitable for distilling with a 'Medium' rating. It has given high untreated yields in trials and has the second highest rating for resistance to septoria tritici on the 2019/20 Recommended List. This is combined with high resistance to yellow rust and mildew, above resistance to fusarium ear blight and resistance to

⁴² AHDB Cereals & Oilseeds Recommended Lists 2021/22

Scotch Whisky Cereals Technical Note

orange wheat blossom midge. It has stiff straw and moderate resistance to lodging. It is very susceptible to eyespot.

KWS Jackal

KWS Jackal is a high yielding early maturing soft feed wheat variety with a 'Medium' rating for distilling. It has produced very high treated yields on the North region. It has performed well across a range of rotational positions and soil types. KWS Jackal has high resistance to yellow rust and mildew, combined with resistance to orange wheat blossom midge.

Elation

Elation has achieved a 'Good' rating for distilling and is a high-yielding, short, relatively stiff-strawed variety. Elation has high resistance to yellow rust and mildew and is resistant to orange wheat blossom midge. Limited data suggests that the variety is susceptible to eyespot. It has performed particularly well on lighter soils and in a second cereal rotation.

Swallow

A new soft-milling feed variety recommended for the North region. It is rated as 'good' for distilling. Swallow has given high treated yields in the North region (based on limited data) and has a very high treated yield potential in an early sowing situation (based on limited data). It is stiff-strawed and is the shortest variety on the 2021/22 Recommended List. It has resistance to orange wheat blossom midge, but limited data suggests it is very susceptible to eyespot.

Wheat Group 4 Varieties Suitable for Distilling⁴³

	LG Skyscraper	LG Spotlight	LG Sundance	KWS Jackal	Elation	Swallow
Grain quality						
Endosperm texture	Soft	Spot	Soft	Soft	Soft	Soft
Protein content (%)	11.6	11.5	11.5	11.3	11.8	11.3
Hagberg Falling Number	214	288	178	185	210	245
Specific weight (kg/hl)	76.8	78.0	73.8	75.6	77.2	76.3
Chopin alveograph W	-	[73]	[101]	[76]	95	-
Chopin alveograph P/L	-	[0.4]	[0.3]	[0.3]	0.3	-

[Reference: AHDB Cereals & Oilseeds]

⁴³ AHDB Cereals & Oilseeds Recommended Lists 2021/22

Scotch Whisky Cereals Technical Note

Wheat Distilling Varieties Recently Removed

Some seeds might still be available of the following:

Zulu

It has given its best relative performance in the North region. It has moderate resistance to lodging but responds well to plant growth regulators. Zulu has high resistance to mildew and brown rust as well as orange wheat blossom midge. It tends to sprout.

Viscount

A soft-milling feed wheat recommended for the North region. This short and relatively stiff-strawed variety has high resistance to brown rust and orange wheat blossom midge.

Leeds

A soft-milling feed wheat with a high specific weight. It has a high UK yield and has given very high yields in the North region but is rather late maturing. It has high resistance to fusarium ear blight but is susceptible to eyespot and very susceptible to mildew. Leeds is resistant to orange wheat blossom midge.

Scotch Whisky Cereals Technical Note

Attributes for Distilling Wheat Varieties⁴⁴

Acceptable distilling varieties are soft wheat varieties achieving high or medium alcohol yields, relatively low viscosity, and a viable agronomic package.

Attribute	Measure	Control
<p>Soft Grain Texture</p> <p>Identify varieties with soft endosperm texture</p>	<p>Varietal hardness classification as identified via BSPB and AHDB analysis</p>	<p>Support UK Flour Millers Group 3 and soft Group 4</p>
<p>Alcohol Yield</p> <p>Identify varieties with high levels of accessible starch to be converted to fermentable sugars under distillery conditions</p>	<p>Direct alcohol yield determination through SWRI laboratory processing</p> <p>Total nitrogen (inversely related to starch content)</p>	<p>Best established distilling variety currently available</p>
<p>Process Efficiency</p> <p>Identify varieties with low processing viscosity impact</p>	<p>RVA (Rapid Visco-Analyser) measurement of grain & direct determination of residue viscosity after SWRI laboratory distillation</p>	<p>No higher than the average of acceptable distilling varieties</p>
<p>Sustainability</p> <p>Identify varieties likely to contribute to lowering the carbon footprint of wheat use in distilling</p>	<p>Improved agronomic characters relevant to climate change, improved resistance to pests and diseases, and reduced or improved use of fertiliser or pesticides</p>	<p>No higher than the average of existing acceptable distilling varieties</p>

⁴⁴ Scotch Whisky Association

Other Cereals

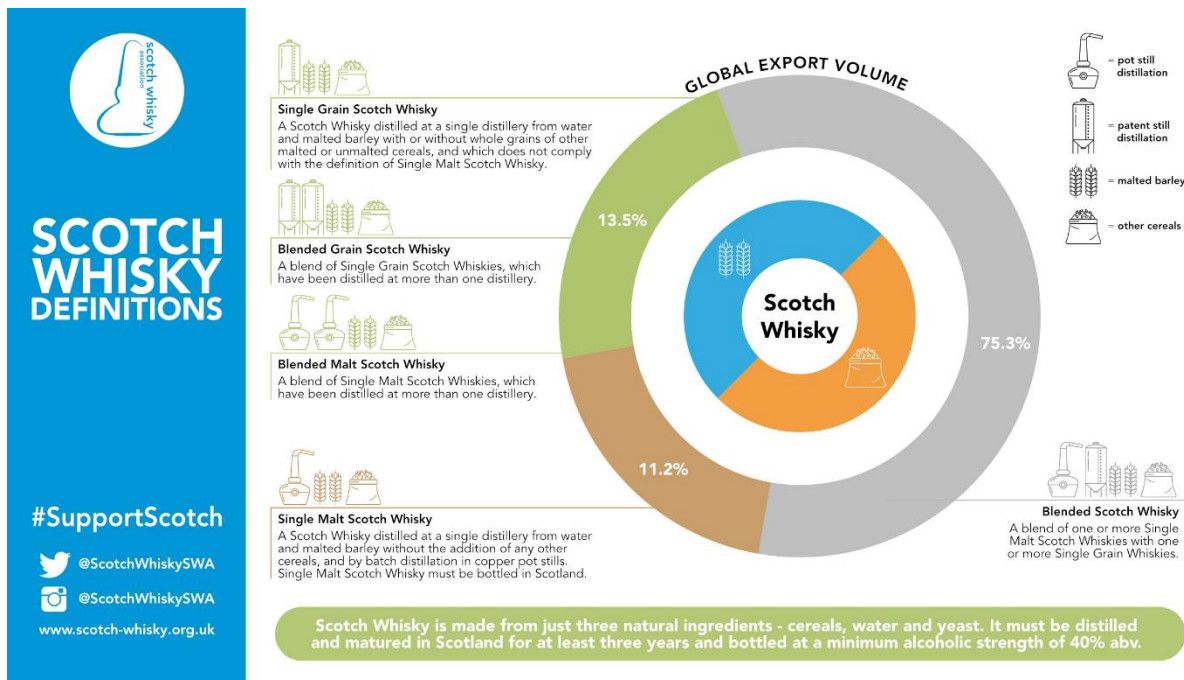
The Scotch Whisky definition makes no specific reference to the cereals to be used in Scotch Whisky production other than the requirement for malted barley, which must of course be used exclusively for Single Malt Scotch Whisky and must form part of the mash in Grain Scotch Whisky. The Scotch Whisky Technical File refers to the use of other cereals in Grain Scotch Whisky production and states that wheat and maize are the most common. There are other cereals which may form part of the mash for a Grain Scotch Whisky, for example rye and oats, but other relevant legal requirements need to be considered, most notably those relating to traditional practice. These requirements will have an influence on which cereals can be used and in what proportions, and the resulting product needs to have the colour, taste, and aroma within the generality of products traditionally sold as 'Scotch Whisky'. We strongly urge companies which are considering using these other cereals, including rye or oats, to contact the SWA legal team on this topic before doing so.



Pre-1984, maize was the traditional grain of choice until it was effectively replaced by wheat during the 1980's; primarily because prices and EEC refunds made it attractive. Some companies have switched back to maize to gain the required consistency. Other advantages are processability and energy savings. A basic specification for distilling maize is moisture (about 15%) and large, full kernels (to give easier processing). It is an-effective source of carbohydrate for distillers containing approximately 72% starch (on a dry weight basis). A basic specification for distilling maize is:

- Moisture, about 15%; and
- Large, full kernels (to give easier processing).

APPENDIX 1 – Scotch Whisky Facts⁴⁵




- Scotch Whisky exports were worth £3.8bn in 2020 (down from 4.9bn in 2019).
- Scotch Whisky leads the way for British food and drink in overseas markets, accounting for 75% of Scottish food and drink exports and 21% of all UK food and drink exports.
- 36 bottles of Scotch Whisky are shipped from Scotland to 166 markets around the world each second, totalling over 1.14bn every year.
- Over 20 million casks lie maturing in warehouses in Scotland.
- Top export markets by value are USA, France, Singapore, Taiwan, Germany, and Spain.
- Around 40,000 jobs are supported by the Scotch Whisky industry of which 10,000 are directly within the industry.
- Employment is located across the length and breadth of Scotland in both rural and urban settings. Many are in areas where few or no alternative jobs are available.
- Distillers are committed to promoting environmental sustainability investing over £1 billion in renewable energy systems over the last few years.
- Over £1.5 billion a year is invested across the industry’s supply chain.
- There are 134 operating distilleries with plans for many more.
- The SWA has a robust code of practice on marketing and promotion to which all members must commit. The SWA membership represents circa 90% of the productive capacity of the Scotch Whisky industry.
- There continues to be optimism about future prospects over the next two decades as new emerging markets grow and mature markets develop.
- Exporting to around 175 markets, Scottish Whisky adds over £5 billion to the UK economy per year, making it bigger than the British iron and steel, textiles, shipbuilding, or computer industries. The whisky sector boosts the UK economy by adding jobs and increasing exports.

⁴⁵ Scotch Whisky Association Facts & Figures 2020

Scotch Whisky Cereals Technical Note

- The Scotch Whisky industry is the UK's largest single food and drink sector, larger than meat, dairy, beer, and soft drinks. A home-grown industry that dates back to 1494, the Scotch Whisky industry has long been considered a cornerstone of the economy.

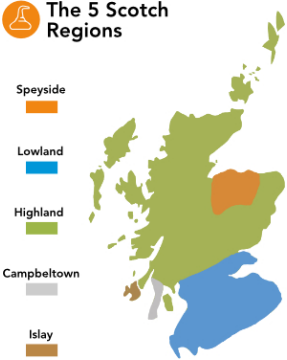


SCOTCH WHISKY: AT A GLANCE 2019

#DISCOVERSCOTCH

@ScotchWhiskySWA
 @ScotchWhiskySWA
 www.scotch-whisky.org.uk

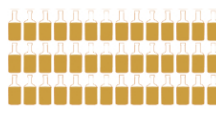
The 5 Scotch Regions



- Speyside
- Lowland
- Highland
- Campbeltown
- Islay

Did you know?

- Scotch Whisky is exported to around 180 countries worldwide
- Exports of Scotch Whisky earned £156 every second in 2019
- More Scotch is enjoyed worldwide than American, Canadian and Irish whiskies combined
- Scotch Whisky accounts for 20% of all UK food and drink exports
- The term 'whisky' comes from the Gaelic 'uisge beatha' or 'uisquebaugh' meaning 'water of life'
- Drinkers in the UK often choose to enjoy Scotch with just a little water, but in Spain they mix it with cola, in China with cold green tea, and in Brazil with coconut water
- The earliest reference to distilling in Scotland appears in the Scottish Exchequer Rolls in 1494



42

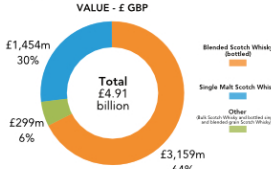
BOTTLES OF SCOTCH WHISKY ARE EXPORTED EVERY SECOND

The Economic Impact

adds £5.5bn of value to the UK economy	supports salaries worth £1.3bn in Scotland alone	supports over 42,000 jobs across the UK
Over 20% of all UK food and drink exports, and 1.3% of all UK goods	Scotch is a significant contributor to the rural economy – it supports 7,000 jobs in rural Scotland	

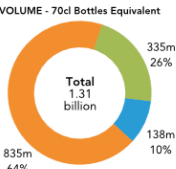
The 2019 Exports

VALUE - £ GBP



Total £4.91 billion

VOLUME - 70cl Bottles Equivalent



Total 1.31 billion

£3 IN EVERY £4 SPENT ON SCOTCH WHISKY IN THE UK IS TAX



Scotch Whisky Cereals Technical Note



SCOTCH WHISKY: A BRIEF HISTORY

#DISCOVERSCOTCH

@ScotchWhiskySWA

@ScotchWhiskySWA

The earliest documented record of distilling in Scotland. An entry in the Exchequer Rolls lists "Eight bolls of malt to Friar John Cor wherewith to make aqua vitae."

1494



1644

The first official taxes on Scotch Whisky production are imposed, causing a rise in illicit whisky distilling across Scotland.

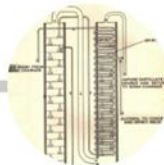


Scotland's Bard, Robert Burns, writes the poem 'Scotch Drink' which includes the line "O thou, my Muse! guid auld Scotch drink!"

1785

Aeneas Coffey invents the Patent Still. This led to the production of lighter flavoured Grain Whisky which, when blended with more fiery malts, extended the appeal of Scotch Whisky.

1831



1823

The Excise Act is passed and illicit stills and smuggling of Scotch began to fall away. In their place, legal and licenced distilleries flourished, reaching a peak of over 300 in the years shortly after its enactment.



1880

The phylloxera beetle devastates French vineyards. Scots are quick to take advantage, and Scotch Whisky replaced brandy as the spirit of choice.

1912

The Wine & Spirit Brand Association is formed. It became the Whisky Association in 1917 and then, in 1942, evolved again to become the SWA as we know it today.



1920

Prohibition begins in the United States of America. The federal government made an exemption for whisky prescribed by a doctor for medicinal purposes.



Info 1933
First statutory definition of Scotch Whisky.



1994

The 500th anniversary of whisky production in Scotland. Exports of Scotch Whisky reach £2 billion for the first time in history.



1939

World War II reshaped the industry's history. One Cabinet Minister said "the country needs food, dollars mean food, and whisky means dollars." Annual export targets were agreed and producers increasingly looked to overseas markets.



2009

The Scotch Whisky Regulations come into force. The rules set out how Scotch Whisky must be produced, labelled, packaged and advertised, helping to protect the reputation of Scotch.



2019

Scotch Whisky is the world's undisputed premier whisky. 41 bottles of Scotch are shipped from Scotland every second to around 180 global markets.

APPENDIX 2 – Sources of Information

Agricultural Industries Confederation: <http://www.agindustries.org.uk>

The AIC promotes the benefits of modern commercial agriculture in the UK and supports collaboration throughout the food chain. It is the agri-supply industry's leading trade association.

British Society of Plant Breeders (BSPB): <http://www.bspb.co.uk/>

BSPB (based in Ely) represents plant breeders and breeders' agents, breeding and marketing varieties of all the major arable, fodder and vegetable crops and amenity grass in the UK.

DEFRA: <https://www.gov.uk/government/organisations/department-for-environment-food-rural-affairs>

The Department for Environment, Food and Rural Affairs (DEFRA) is the government department responsible for environmental protection, food production and standards, agriculture, fisheries, and rural communities in the UK.

DG AGRI: http://ec.europa.eu/agriculture/index_en.htm

DG AGRI is responsible for the European Union area of agriculture and rural development (dossier driven).

Euromalt: <http://www.euromalt.be/>

Euromalt is the trade association representing the malting industry in the European Union. Established in 1959 Euromalt aims at the representation and promotion of interests of the EU malting industry at EU and international levels, of the sourcing of raw materials as well as of the manufacture, distribution, and malt trade.

AHDB Cereals & Oilseeds: <http://cereals.ahdb.org.uk/>

AHDB Cereals & Oilseeds is the cereals and oilseeds division of the Agriculture and Horticulture Development Board (AHDB). The Crop Committees play a crucial role in producing the AHDB Recommended List (RL) by examining trial results and making variety recommendations to the main RL project board.

Malting Barley Committee: <http://www.ukmalt.com/malting-barley-committee>

The Malting Barley Committee and its subordinate Micromalting Group operate the approval system. The Committee feeds into the AHDB Barley & Oats Committee – each barley variety which features on the AHDB's Recommended List includes reference to its approval by the Malting Barley Committee for distilling and brewing use.

James Hutton Institute: <http://www.hutton.ac.uk>

The James Hutton Institute brought together the Macaulay Land Use Research Institute and Scottish Crop Research Institute on 1 April 2011. The new organisation combines existing strengths in crops, soils and land use and academic research. The Institute is increasingly seeking to strengthen its profile in relation to supporting the Scotch Whisky industry.

Maltsters' Association of Great Britain (MAGB): <http://www.ukmalt.com>

MAGB is the trade association of the UK malting industry and represents over 98% of UK malt production.

Scotch Whisky Cereals Technical Note

National Farmers Union (Scotland): <http://www.nfus.org.uk>

The purpose of NFU Scotland is to promote and protect the interests of its members by influencing government, the supply chain, and consumers in order to secure a sustainable future for Scottish agriculture.

Scottish Agricultural Organisation Society: <https://saos.coop/>

SAOS provides a range of specialist information and services – strategy development, training, governance, and initial set-up advice for agri co-ops.

Scotland's Rural College (SRUC): <http://www.sruc.ac.uk/>

Barony, Elmwood and Oatridge Colleges and SAC have merged to become SRUC. It delivers comprehensive skills, education, and business support for Scotland's land-based industries, founded on research, education, and consultancy. It cooperates with the James Hutton Institute and has influence across the farming community at grass roots level.

Scotch Whisky Research Institute: <http://www.swri.co.uk/>

SWRI provides a centre of academic excellence dedicated to the needs of the Scotch Whisky industry primarily, but also undertakes work on other spirits. Collaborative research is important in the Scotch Whisky industry in terms of product protection, technological development, innovation, and sustainability (of raw materials and the industry).

Scottish Quality Crops: <http://www.sfqc.co.uk/assurance-schemes/crops-and-fresh-produce/scottish-quality-crops-sqc/>

Scottish Food Quality Certification Ltd is the independent organisation responsible for certifying and administering the Scottish Quality Combinable Crop Scheme. SFQC was the first food and farming certification body in Europe to be awarded EN450 11 status, adopted by the EU as the yardstick for food certification schemes.

Scottish Environment Protection Agency: <http://www.sepa.org.uk/>

SEPA is Scotland's environmental regulator. Its purpose is to protect and improve the environment, including the sustainable management of natural resources.

Scotch Whisky Association: <http://www.scotch-whisky.org.uk/>

The SWA works to sustain Scotch Whisky's place as the world's leading high-quality spirit drink and its long-term growth worldwide.

Scottish Government: <http://www.gov.scot/topics/research>

The Scottish Government provides around £48m of funding each year towards a portfolio of strategic Rural Affairs, Food & the Environment Science & Research, and is one of the largest funders of agri-environmental research in the UK.

APPENDIX 3 – Glossary of Terms

AHDB	Agriculture & Horticulture Development Board
BSPB	British Society of Plant Breeders
DP	Diastatic Power (high enzyme)
DWB	Dry Weight Basis
EPH	Epi-heterodendrin – a glycosidic nitrile produced in germinating barley
FSA	Food Standards Agency
GN	Glycosidic Nitrile
GM	Genetically Modified
HACCP	Hazard Analysis and Critical Control Points
JHI	James Hutton Institute
LPA	Litres of Alcohol
MAGB	Maltsters’ Association of Great Britain
UK Flour Millers	National Association of UK Flour Millers
NFUS	National Farmers Union (Scotland)
PGR	Plant Growth Regulator
SNR	Soluble Nitrogen Ratio
SPIRIT YIELD	Spirit Yield is the product of hot water extract
SQC	Scottish Quality Crops
SRUC	Scotland’s Rural College
SWA	Scotch Whisky Association
SWRI	Scotch Whisky Research Institute