Single malt Scotch whisky from 59° North

Below: Germinating malt from the 2010 crop of Tartan during malting in June 2011.

Collaboration between Orkney's Highland Park Distillery and the University of the Highlands and Islands' Agronomy Institute is allowing Scotland's most northern distillery to use the country's most northerly-grown malting barley in a project to produce an all-Orkney whisky.

by ***Peter Martin***
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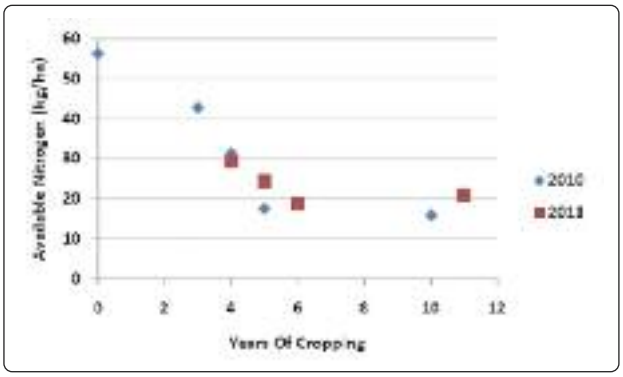
Located in Orkney, just off the north coast of Scotland, Highland Park Distillery is the most northerly whisky distillery in the country. It has been part of the Edrington Group since 1999, but can trace its origins back to 1798 when distillation was already occurring on the site. It was then called High Park, using the same water source as today's distillery. Highland Park aims to produce whiskies which reflect the unique environment of Orkney and this is manifested in aspects like its continued use of local peat, retention of traditional dunnage warehouses and, most importantly, its floor malting facilities. Its ability to produce malt on-site has made it economically viable for the distillery to explore the feasibility of using Orkney-grown barley as another stage in maximising its use of local resources in a project to produce an all-Orkney whisky.

Climate restrictions

As a result of Orkney's far north location (59°N), few modern varieties of malting barley are suited to the islands' climate and for most of the 20th century, Highland Park imported barley from a range of foreign sources like Australia and Denmark as well as from the Scottish mainland. These imports replaced locally grown bere (a very old type of barley) which was still being purchased up until 1925. Small quantities of local bere were again sourced in 1942, during the second world war, when imports were greatly restricted and the priority for UK agriculture was food production. Although the low grain and alcohol yields of bere made the shift to modern malting barley an economic necessity for volume distillation, bere is well-suited as a crop to the local climate because it has a short growing season and can usually be harvested in late August or early September.

The Orkney climate presents some major challenges to the production of good quality malting barley. In particular, high winter rainfall and very strong, salt-laden winds mean that winter varieties do not survive well and are therefore not grown. Spring varieties can only be planted once the soil dries out and temperatures are favourable – this is not usually before mid-April. As a result of its northern maritime location, the growing season is cool (the average temperature over June, July and August is 12.1°C) so that UK cereal varieties mature more slowly than they do further south and are only ready for harvesting around mid-September, by which time rain and winds can make harvesting difficult.



Below: Figure 1. Available soil nitrogen in relation to number of years of annual cropping for farmers' fields in Orkney. The field at 0 years of cropping was a field at Orkney College under grass.

Table 1. Grain moisture content (mc), grain yield and predicted spirit yield (PSY) of Orkney-grown malting barley varieties treated with (+F) and without (-F) a fungicide spray and harvested on 8 September 2009.

	Tartan		Oxbridge		Decanter		Appaloosa		Publican		LSD[1]
	+F	-F	+F	-F	+F	-F	+F	-F	+F	-F	
Grain moisture at harvest (%)	20.5	19.2	20.5	19.1	20.2	19.1	21.5	19.6	23.6	21.6	0.8
Grain Yield (t/ha at 15% mc)	6.41	5.84	6.35	5.83	6.53	5.77	6.53	5.45	6.41	5.78	0.61
PSY (l/t dry weight)	439.1	437.2	438.3	438.8	433.1	433.2	436.6	434.4	440.3	437.2	____

[1]*LSD, least significant difference between treatment means*

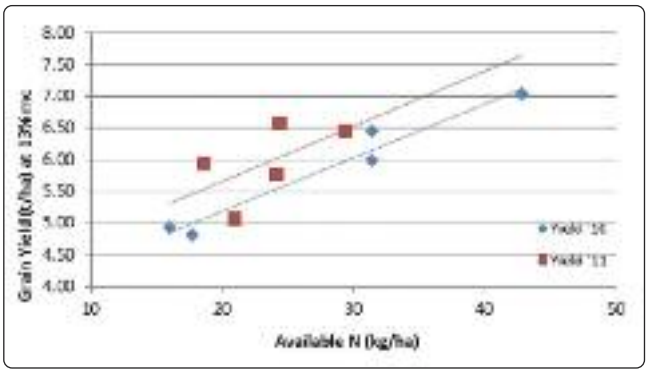
Table 2. Grain moisture content (mc), grain yield and predicted spirit yield (PSY) of Orkney-grown malting barley varieties treated with (+F) and without (-F) a fungicide spray and harvested on 11 September 2011.

	Tartan		Moonshine		Belgravia		Shuffle		LSD1
	+F	-F	+F	-F	+F	-F	+F	-F	
Grain mc at harvest (%)	22.8	21.9	23.8	22.6	24.6	23.5	25.6	23.1	1.3
Grain Yield (t/ha at 15% mc)	5.80	5.64	6.26	5.64	6.17	5.46	6.58	5.98	0.70
PSY (l/t dry weight)	436.3	432.1	425.0	421.9	426.8	422.2	432.1	427.3	____

[1]*LSD, least significant difference between treatment means*

An Orkney field of Tartan in August 2010 being visited by (left to right): Russell Anderson (Distillery Manager, Highland Park), Dr Bill Crilly (Technical Support Manager, Edrington Group) and Paul Huntley (Director of Cereal Seeds, McCreath Simpson & Prentice Ltd). Note the cruise ship in Scapa Flow rather than the British Grand Fleet!

If harvesting is delayed into October, there is a high chance of crop loss. In addition to climate, it has generally been assumed that it would not be possible to produce low nitrogen content malting barley because of the high fertility of Orkney soils. This is a result of most farms being primarily for livestock so that large quantities of animal manure are returned to the land and arable crops are only usually grown for 2–3 years before the land is returned to grass.



Below: Figure 2. Grain yield (at 15% moisture) on available soil nitrogen of fields in Orkney which were used for growing Tartan in 2010 and 2011. Lines of best fit have been added to each year's data.

Collaboration between Highland Park and the Agronomy Institute (AI) at Orkney College to investigate the feasibility of growing malting barley in Orkney started with a trial of non-glycosidic nitrile producing varieties in 2009. The objective of this trial was to find a variety which combined good agronomic performance with the potential for high quality malt production. Amongst the varieties tested (Table 1, previous page), Tartan was found to be the most suitable for Orkney because of its good yield with and without fungicide, high predicted spirit yield (PSY) and, most importantly, because it was ready for harvesting before the other varieties. One surprising result from the trial was that samples of grain from all varieties produced good micromalting results, indicating that there was the potential for producing very good quality malting barley in Orkney.

Highland Park was keen to take the project to the next stage and, in 2010, asked the AI to develop and manage a supply chain to produce about 50 tonnes of Tartan annually. Five growers were recruited for this, none of whom had ever grown malting barley before and a total of 10ha was planted on the same fields in both 2010 and 2011. It was recognised that low grain nitrogen was most likely to be achieved by using fields which had been in arable cropping for several years, in which soil nitrogen levels were expected to be low.

Field selection

This was one of the main criteria for field selection. Soil nitrogen was monitored in these fields by analysing soil from them in February of each year. The analyses confirmed that the amount of available soil nitrogen depended on the number of years for which fields had been in arable cropping (Figure 1) and seemed to drop until about year 5 or 6, after which it stabilised at about 18–20kg N/ha. Data from 2010 and 2011 indicated that while the highest grain yields were associated with fields with the highest levels of available soil nitrogen (Figure 2), these fields were also most likely to produce high levels of grain nitrogen and, in 2010, three growers had grain nitrogen levels above the 1.65% threshold set by Highland Park.

Since most growers used low levels of nitrogen fertiliser (range, 40 to 112kg N/ha and 34–70kg N/ha in 2010 and 2011, respectively), available soil nitrogen fell in most fields after the 2010 analyses and, in 2011, all growers achieved grain nitrogen levels below 1.65% (average, 1.50%; range, 1.42-1.61%). The available data suggest that under Orkney conditions, growers are unlikely to be able to achieve grain nitrogen levels below 1.65% until the level of available soil nitrogen has dropped to about 30 kg N/ha and that this is most likely in fields which have had about four years of arable cropping. With all fields now having available soil nitrogen levels below this threshold, the challenge will be to manage the application of fertiliser nitrogen so that yield is maintained without causing a large increase in grain nitrogen.

The 54t of Tartan produced from the 2010 crop was malted in June 2011 and then distilled in August, producing around 18,000 litres of alcohol. This was filled into ex-sherry Spanish oak casks and is being matured in dunnage warehouse at Highland Park. This is thought to be

Left: Malting barley variety trial at Orkney College (UHI) in July 2011.

the first Orkney barley which has been malted and distilled at Highland Park since 1942.

Tartan is soon to be withdrawn. It has good malting qualities but its field yield is lower than other varieties. At the risk of oversimplifying the situation, early varieties tend to be lower yielding than later ones because they have a shorter growing season. Its earliness was probably only an advantage for growers in the north and with breeders not finding much demand for it, HGCA are to discontinue its recommendation.

Tartan malt being spread out on one of Highland Park's malting floors in June 2011.

Replacement

Thus the project is looking for a replacement variety and so a second variety trial was run in 2011. The main data from the trial is summarised in Table 2 and shows that while the other varieties mostly had higher grain yields than Tartan, they did not have as high a PSY and had higher grain moisture contents at harvest, indicating that they were later maturing. In the absence of there being a suitable replacement variety for Tartan, the supply chain will continue to grow Tartan, with each grower using his own farm-saved seed. By continuing to use a variety which is no longer commercially grown, but one which is well-suited to Orkney's environment, another interesting strand will be added to the all-Orkney whisky story. The lack of availability of early maturing, high quality malting barley varieties is also considered to be a problem in more traditional malting barley growing areas in northern Scotland and reflects the emphasis placed by breeders on grain yield, which is usually not associated with earliness.

An important aspect of the collaboration between the AI, HP and the supply chain has been a free exchange of information between all parties. Growers have shared details of their cultivation practices and payment premiums and deductions from the crop while the distillery has provided information on the quality of each growers' grain and funded the AI to collect, collate and report the information from the different components of the supply chain. Results are then presented and discussed at an annual meeting of the supply chain over the winter, when plans for the next season's crop are outlined. The development of the Orkney supply chain demonstrates how collaboration between industry, research and growers can provide mutual benefits and result in the development of new markets and products, even in a challenging environment like Orkney's.

The author

Peter Martin is Director of the Agronomy Institute at Orkney College (University of the Highlands and Islands). He recognises the assistance given in producing this paper from Russell Anderson and Bill Crilly from the Edrington Group and John Wishart and Billy Scott also of the Agronomy Institute. You can reach him at peter.martin@orkney.uhi.ac.uk and find out more about the Institute's work at *www.agronomy.uhi.ac.uk.*

Above: Highland Park still house during the distillation of Tartan in August 2011.

Left: Entrance to Highland Park Distillery, Kirkwall, Orkney.