

## Final Project Summary

<b>Project title</b>	Improving winter malting barley quality and developing an understanding of the interactions of introgressions with genetic background (IMPROMALT)		
<b>Project number</b>	21130013	<b>Final project report</b>	PR626
<b>Start date</b>	April 2013	<b>End date</b>	October 2020
<b>AHDB funding</b>	£106,040	<b>Total cost</b>	£1,724,221

### What was the challenge/demand for the work?

There are major end-user concerns about the long-term sustainability of the spring barley crop, in part due to changing climatic conditions. With drought during grain fill increasing nitrogen and wet-weather harvest delays impacting on quality, some UK regions have had to down-grade their malting specifications to source sufficient intake. 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 significantly better malting quality of modern spring barley varieties, compared to the winter crop – in terms of hot water extract, friability and homogeneity. There is, therefore, a need to improve the malting quality of winter barley, if the crop is to address the sustainability concerns of the industry.

### How did the project address this?

The project built on the [AHDB-funded LINK project AGOUEB](#), which identified two distinct barley genomic regions, located on barley chromosomes 1H and 3H, associated with increased malt extract in spring barley varieties.

The production of winter barley lines with improved malting quality, by collaborating with breeding companies, was the primary objective of this project. The work tested the hypothesis that introduction of spring barley QTL alleles, at the regions on chromosomes 1H and 3H, together with a targeted recombination between the winter allele at the 4H vernalisation locus and a spring allele associated with a higher level of thermostability at the linked *beta*-amylase locus, would produce a significant improvement in the malting quality of winter barley.

Additional objectives, to that funded by AHDB, involved the augmentation of genotypic and phenotypic barley data sets derived from variety (National List and Recommended Lists) trials by ~20% to refine the QTL intervals for the target regions introgressed from the spring barley quality donor into the winter barley background.

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### What outputs has the project delivered?

The IMPROMALT project was successful in its main objectives. There was a substantial augmentation of the genotypic and phenotypic datasets, with the inclusion of trial data from 2007–18, and through the use of the new 50K, rather than the previous 9K genechip, for SNP genotyping. This resulted in the refined delineation of the target QTL regions on 1H and 3H, as well as an improved genetic understanding of the changes in UK barley varieties over the last decade. The breeding companies involved in the project were able to utilise this information to produce winter lines that contained the desired regions of spring quality in five different crosses. Importantly, these winter lines showed a significant improvement in malting quality parameters. In addition, other material was produced, including a suite of near-isogenic lines that allowed the further delineation of the target region on 3H.

### Who will benefit from this project and why?

The IMPROMALT winter lines are being used with the collaborating breeding companies (which include all current UK-based barley programmes) to help produce the next generation of malting-quality winter barleys for the UK. Such varieties will benefit UK farmers by providing a winter malting barley that helps spread harvest load and provides another malting quality crop that meets higher malting specifications. The use of a quality winter crop will also spread the risk for the end-user industries and potentially allow some market differentiation. 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.

### If the challenge has not been specifically met, state why and how this could be overcome

The IMPROMALT project was successful in its main objective. It produced winter barley lines with significantly improved malt quality. However, the long-term sustainability of the UK barley crop is a major multi-faceted challenge for the industry, of which an improved winter crop is only a part of the solution.

<b>Lead partner</b>	The James Hutton Institute
<b>Scientific partners</b>	NIAB
<b>Industry partners</b>	KWS UK Ltd, RAGT Seeds Ltd, Saaten Union UK Ltd, SECOBRA Research, Limagrain UK Ltd, Syngenta Seeds Ltd, The Maltsters Association of Great Britain (MAGB), Scotch Whisky Research Institute, Mylnefield Research Services Ltd (now James Hutton Ltd)
<b>Government sponsor</b>	BBSRC

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