Future-proofing cereals for climate change drought conditions

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Credit: Heriot-Watt University

Scientists at Heriot-Watt University have identified a gene responsible for drought resistance in barley which, it is believed, could help future-proof the cereals industry to increasingly dry conditions as climate

change gathers pace.

Publishing the results of nearly five years of work in the *Journal of Plant Physiology and Biochemistry*, the team demonstrated that gene HvMYB1 controls stress tolerance in cereals such as barley. This is the first time HvMYB1 has been associated with drought resistance.

Dr. Peter Morris from the Institute of Earth and Life Sciences at Heriot-Watt University conceived the research idea. He successfully secured funding and led the project team (Dr. Charlotte Wendelboe-Nelson and Dr. Ross Alexander).

Dr. Morris said: "This is a significant finding that will allow more drought resistance crops to be bred in the future. Drought is already impacting yields with the European cereals harvest hit particularly hard in 2018. A prolonged, dry and hot summer significantly impacted yields and quality.

"As climate change gathers pace and we experience more extreme seasons, it is essential we can maintain continuity of supply. This is significant for key industries like Scotch whisky, one of the UK's leading export items. Our project focused specifically on barley; one of the three ingredients used in the production of Scotch whisky.

"Barley has over 39,000 genes, almost double the number for humans, so characterizing one particular gene which promotes drought resistance has been a considerable challenge. By increasing the expression of this particular gene in test plants and simulating drought conditions, we've been able to prove that plants in which HvMYB1 is more prominently expressed are able to survive prolonged periods of drought.

"Genetic variation is essential in plant breeding for resilience so we expect this research will now be used by plant breeders as a marker for

drought resistance. It will help focus attention on different barley varieties in which this gene is naturally expressed more prominently. This may lead to greater variation in the gene pool of crop plants and more drought resistant crops in future years.

"This also has important implications for the wider cereals industry including the production of wheat, maize and rice."

Dagmar Droogsma, Director of Industry at the Scotch Whisky Association, said: "The Scotch Whisky industry relies on a sustainable and secure supply of good quality raw materials, now and in the future. Quality barley is central to the success of the Scotch Whisky industry: approximately 90% of the barley used for Scotch is sourced from Scotland, with the rest from around the UK and the EU when necessary. The SWA works closely with specialists at Heriot-Watt university, and others in the sector, to ensure that the industry is equipped to adapt to any changes that may arise from a changing climate. We therefore welcome this research which helps to provide resilience against the effects of climate change and to sustain the diversity of barley varieties used for Scotch Whisky."

"Agriculture in Scotland supplies some of the best grain anywhere in the world, and these recent findings contribute to an industry-wide programme of research and development which helps to maintain Scotch Whisky's competitive edge as an iconic Scottish product. The Scotch Whisky industry supports 10,000 jobs across Scotland, and we are proud to have funded this research into a fundamental element of its supply chain."

The value of cereals to the UK economy is significant. In 2018, the value of wheat rose by £95 million to £2,084 million while the overall value of barley rose by £85 million to £957 million as a result of higher prices (up 10%). The whisky industry is worth £5 billion to the Scottish economy.

The research was funded by the Scotch Whisky Association, which aims to secure the sustainability of the Scotch whisky industry, and Interface, which matches businesses with Scotland's world-leading academic expertise.

Provided by Heriot-Watt University