

## Small gene, big impact: How the MKK3 gene controls dormancy in barley

Kopenhagen/Gatersleben, 07.11.2025 **The Carlsberg Research Laboratory, the world's first industrial research laboratory, has announced a scientific breakthrough. This could help protect crops from climate-related failures. In line with the motto 'Science should be shared like beer', the results of the Carlsberg-led research, which also involved the IPK Leibniz Institute, have now been published in the renowned journal Science. This makes them available to scientists and breeders worldwide.**

Unpredictable weather intensified by climate change causes billions of dollars in losses to cereal crops like barley, wheat and rice, as premature sprouting before harvest - known as pre-harvest sprouting (PHS) - reduces grain quality and threatens food security. Grains that germinate before harvest often don't meet quality requirements in downstream industrial processes and are more susceptible to spoilage, mould, and fungal contamination - meaning the grains are often not even suitable as animal feed. These losses can be devastating to farmers, communities and businesses that rely on a consistent production of high-quality crops. The Carlsberg Research Laboratory-led international team has uncovered how the complex genetics of a single gene, MKK3, controls seed dormancy and sprouting risk in barley, revealing new ways to breed crops that are both resilient to climate extremes and suited for diverse agricultural needs.

A team of international researchers led by the Carlsberg Research Laboratory and including the IPK has discovered how the MKK3 gene is regulated by a complex genetic process that controls dormancy and germination risk in barley. This opens up entirely new avenues for breeding plants that can withstand extreme weather conditions and meet a wide range of agricultural requirements.

"At Carlsberg, we believe that science should be shared," said Birgitte Skadhauge, Vice President and Head of the Carlsberg Research Laboratory. "By publishing our research in Science, we're inviting the global scientific community to build on our findings, accelerate progress, and help secure the future of food. This breakthrough is bigger than beer - it's about brewing a better tomorrow for everyone.

Using advanced genetic analysis and field trials across continents, the researchers mapped the diversity of MKK3 gene variants in barley from around the world. "Our work shows how centuries of farming and climate adaptation have shaped the genetic landscape of this vital crop and provides a roadmap for breeders to balance dormancy and sprouting risk - helping farmers everywhere grow better crops, even as weather becomes more unpredictable," said Christoph Dockter, Head of Cereal Crop Development at the Carlsberg Research Laboratory.

The team identified how different versions of the MKK3 gene affect seed dormancy and sprouting risk, with some variants conferring greater resilience to wet-harvest conditions. Figures from the research illustrate the worldwide distribution of these gene variants, showing the selection dynamics of century-long domestication and breeding and highlight

### Press Release

Prof. Dr. Nils Stein  
Phone: +49 39482 5522  
[stein@ipk-gatersleben.de](mailto:stein@ipk-gatersleben.de)

Dr. Christoph Dockter  
Phone: +45 2789 1861  
[christoph.dockter@carlsberg.com](mailto:christoph.dockter@carlsberg.com)

**Medienkontakt**  
Christian Schafmeister  
Phone: +49 39482 5461  
[schafmeister@ipk-gatersleben.de](mailto:schafmeister@ipk-gatersleben.de)

Mark Rasmussen  
Phone: +45 6016 8628  
[mark.rasmussen@carlsberg.com](mailto:mark.rasmussen@carlsberg.com)

regions where farmers face the greatest risk from PHS. Data from multi-year field trials show how targeted breeding can help balance crop performance and resilience, supporting sustainable agriculture in a changing climate.

“The analysis of MKK3 gene variants and their global distribution was substantially supported and accelerated by the barley pangenome analysis led by the IPK,” explains Nils Stein, Head of the Gene Bank department at the IPK. “Our work at the IPK aims to systematically make the full genomic diversity of our crops accessible for research and breeding purposes.”

**Original publication:**

Jørgensen *et al.* (2025): Post-Domestication of selection of MKK3 Shaped Seed Dorancy and End-Use Traits in Barley. Science. DOI: [10.1126/science.adx2022](https://doi.org/10.1126/science.adx2022)

**Photos:**



The photos show three ears of barley at various stages of maturity prior to harvest.

Photos: Christoph Dockter (2); Viktor Hertz/Carlsberg Research Laboratory.

For their research, the scientists are using the site of the long-term experiment 'Eternal Rye Cultivation' at Martin Luther University Halle-Wittenberg. Photo: IPK Leibniz Institute/ S. Dreissig