

Multi-omics resources for targeted agronomic improvement of pigmented rice

June 5 2023



Pigmented rice, such as black, brown and red rice, is rich in essential microelements, including iron, zinc, copper, manganese and selenium. Credit: KAUST; Khalid Sedeek

Pigmented rice is known to be much more nutritious than white rice and could be an important resource to improve human health and combat malnutrition. However, improved yield and agronomic traits are needed if these varieties, which include black, brown and red, are to become widely accepted by farmers.

An international team led by KAUST's Magdy Mahfouz and Khalid Sedeek has shown that desirable agronomic traits of shorter stem length and early maturity can be introduced into black rice.

Their research is published in the journal *Nature Food*.

Sedeek, a postdoc in Mahfouz's lab, says the first step toward making these improvements has been to gather comprehensive genomic information.

"Even though the genomes of several japonica and indica rice [varieties](#) have been assembled, full genome sequences are only available for a few pigmented varieties," he says.

The researchers selected three black and two red rice varieties for whole-genome sequencing. To detect further [genetic variation](#), they sequenced an additional 46 varieties.

"The next step was to analyze the composition of these varieties to identify those with superior nutrition as candidates for improvement," says Sedeek. To do this, the researchers screened 63 varieties of black, red and [brown rice](#), with black rice showing the best nutrient content across a wide range of compounds, including carbohydrates, [amino acids](#), secondary metabolites, lipids, peptides and vitamins.

Pigmented rice (especially black rice) is also rich in essential microelements, including iron, zinc, copper, manganese and selenium. In

particular, the black Indonesian rice Cempo Ireng (the richest rice in iron and the richest black rice genotype in zinc) could provide the daily requirements of these essential elements.

The researchers used these nutrient and metal-ion profiles to identify several nutrient-rich varieties with higher levels of antioxidants and other beneficial compounds and elements, which could be likely varieties for improvement.

One of these was Cempo Ireng. However, despite its pest and [disease resistance](#), farmers are reluctant to cultivate Cempo Ireng due to its long stem and five-month life cycle. Sedeek established a regeneration and transformation system in Cempo Ireng and then used CRISPR/Cas 9 to knock out three flowering time repressors, resulting in a shorter earlier maturing variety.

The improved agronomic traits in pigmented rice varieties have the potential to make them more suitable for cultivation and incorporation into the food chain. However, Mahfouz notes, more work is needed to determine whether these engineered traits can co-exist with other important traits, such as yield, in pigmented rice.

"Nevertheless," he says, "This research provides important resources for crop bioengineers and breeders to continue improving pigmented rice and harness its [potential benefits](#) for human health."

Mahfouz and his team now plan to improve a local red rice variety known as Hassawi rice. This particular rice strain, which is native to Saudi Arabia, holds immense cultural and economic significance in the region. By utilizing CRISPR technology, the group aims to enhance the productivity and other key traits of Hassawi [rice](#) to meet the unique demands of the local Saudi market.

More information: Khalid Sedeek et al, Multi-omics resources for targeted agronomic improvement of pigmented rice, *Nature Food* (2023). [DOI: 10.1038/s43016-023-00742-9](https://doi.org/10.1038/s43016-023-00742-9)

Provided by King Abdullah University of Science and Technology

Citation: Multi-omics resources for targeted agronomic improvement of pigmented rice (2023, June 5) retrieved 23 June 2024 from <https://phys.org/news/2023-06-multi-omics-resources-agronomic-pigmented-rice.html>

This document is subject to copyright. Apart from any fair dealing for the purpose of private study or research, no part may be reproduced without the written permission. The content is provided for information purposes only.