

THE RICE-ING COLORS:

Germination enhances the multi-nutritional properties of pigmented rice revealed through metabolomic and machine-learning techniques

Rhowell Jr. N. Tiozon^{1,2}, Saleh Alseekh², Kristel Sartagoda¹, Alisdair Fernie², and Nese Sreenivasulu¹

¹ International Rice Research Institute, Metro Manila, Philippines ² Max-Planck-Institute of Molecular Plant Physiology, Potsdam-Golm, Germany ³ UP Mindanao, Dept. of Food Sci. and Chemistry, Philippines

PROBLEM

In developing countries, many low income families rely on staple food like milled rice which often lacks critical nutrients.

Thus, there is a need to enhance the nutritional value of rice.



METHOD

Large diversity of pigmented rice (n=1000) from different countries were extracted and subjected to germination.



Targeted and Untargeted metabolomics were employed to determine the compounds. Spectrophotometric techniques were used to quantify the total phenolics, flavonoids, and anthocyanins.

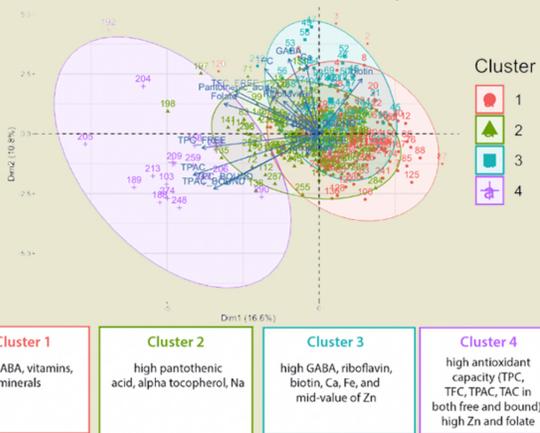
GWAS analysis on pigmented rice sprouts were performed to identify genetic regions related to flavonoids.

Machine learning technique was used to classify the multi-nutritional properties of rice.

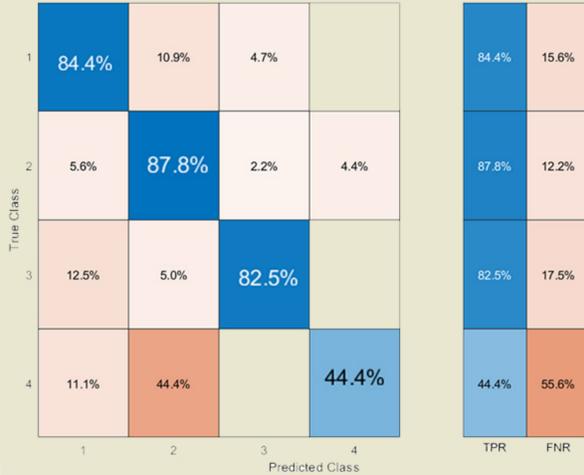
RESULTS

Germination enhances the vitamins, minerals, and antioxidants

Cluster of rice samples



Random Forest model



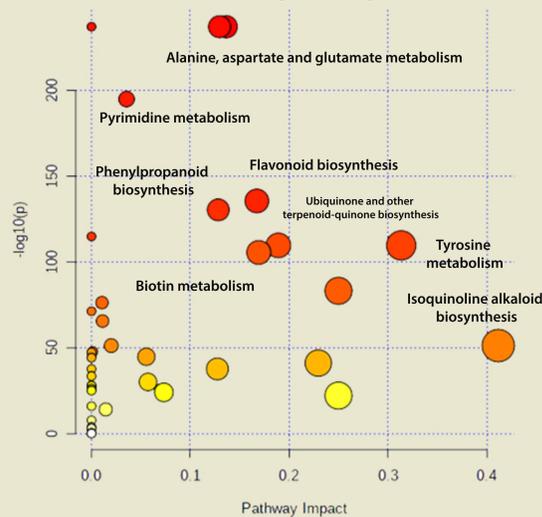
Germination increased minerals such as Ca, Na, Zn, Fe, Al, and K, vitamins such as riboflavin and biotin, and antioxidants like phenolic compounds. Random Forest model was used to classify the rice samples based on its multi-nutritional properties with 98% accuracy.

Germination accumulated flavonoids and identification of genes

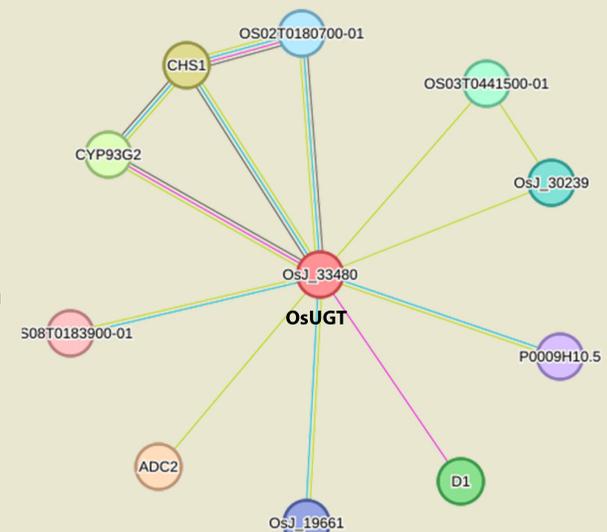
Germination alters the metabolism of peptides and flavonoids. Through genome-wide association studies (GWAS) analysis, genes such as *CHS1* and *UGT* were determined to be associated with flavonoid accumulation in the germination process.

The insights collected here can be useful in breeding nutritious rice.

Pathway analysis



Genes responsible for the flavonoid biosynthesis



Further details are found here:

