COMBINING METABOLOMICS AND GENOMICS TO DISSECT RICE QUALITY AND PROVIDE ROBUST AND TRAIT-RELEVANT TOOLS TO RICE BREEDERS

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Aromatic rice commands the highest prices in both domestic and international markets because consumers prize both the mouth-watering aroma and delicate flavor of the rice. The major aromatic compound in fragrant rice is 2-acetyl 1-pyrroline (2AP). Using a panel of 380 diverse varieties of rice, metabolomics profiling of volatile compounds from the grain and genome wide association with 33,000 single nucleotide polymorphisms (SNPs), the objectives of this study were to identify the sensory traits that describe jasmine rice, the volatile compounds that define those sensory traits and the genetic markers for those compounds. The sensory descriptors fell into three clusters with cluster one of them describing high quality jasmine rice, cluster three describing non-fragrant rice and lower quality jasmine rice falling between the descriptors in clusters one and two. The compounds that most strongly discriminated the high-quality jasmine rice from the other samples were 2AP and four other compounds; two of which required high resolution platforms to reveal their molecular structure and annotation. These five compounds associate with the same SNP on chromosome eight, several are fragrant with a low odor threshold and they provide new information about the pathway of 2AP synthesis. Three QTL were found that associate with high or low amounts of the five compounds. Another 20 metabolites associated either positively or negatively with high quality jasmine fragrance. Significant genetic associations could be found for some of these compounds. By combining these platforms, we deliver new and valuable tools to breeders for selecting highly fragrant rice. We also deliver information and germplasm for the development of new populations targeted to provide appropriate phenotype data to identify QTLs for the other important metabolites identified here.

Biography

Melissa Fitzgerald holds the Australian Food and Grocery Council Chair in Food Science and Technology at the University of Queensland. Her research focuses on using metabolomics profiling platforms to understand the quality and nutritional value of foods. She works on volatile compounds, as well as primary and secondary metabolites in plants and food. She undertook her PhD at La Trobe University in the School of Botany in 1994, and then joined NSW Agriculture in 1997 to Head the Grain Chemistry and Quality Laboratory. In 2004, she was spirited off to the International Rice Research Institute in the Philippines to Head the Grain Quality, Nutrition and Value Adding Program, where she worked for eight years developing new techniques to measure rice quality and directing research in rice quality. In 2012, she returned to Australia to take the Chair at UQ.

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