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Category	: International Rice Research Conference
Select Theme	: Genetic improvement
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Keyword 1	: Biofortification
Keyword 2	: Genome editing
Keyword 3	: Abiotic stress tolerance
Title of Entry	: Fighting Iron deficiency with Ironman: From Arabidopsis to Rice
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Select only one type of presentation	: 15 minute oral presentation
Abstract	: Approximately two billion people are affected by insufficient supply of vitamins and minerals. Bio-fortification of cereal grains is a widely appreciated approach to address the global nutritional crisis. Being consumed by almost half of the world's population, rice is an obvious target for bio-fortification. Through transcriptional analysis of Fe-deficient Arabidopsis (At), we identified a family of peptide-coding genes designated as IRON MAN (IMA), which are conserved in higher plants and positively regulate Fe homeostasis. AtIMAs were found to be involved in the regulation of Fe uptake and secretion of Fe mobilizing compounds (IMCs). As a proof of concept, we generated transgenic rice lines overexpressing AtIMA in the TNG67 background. In contrast to Arabidopsis (Strategy I), which has adopted a reduction-based Fe acquisition strategy, rice take up Fe after binding to root-secreted phytosiderophores without prior reduction of Fe (Strategy II). Transgenic rice lines overexpressing AtIMA (IMA OE lines) showed improved growth and development when compared to wild-type plants. These lines also performed better in terms of shoot fresh weight and chlorophyll content under Fe and phosphate deficiency. The rice genome includes two orthologues of AtIMAs, designated OsIMA1 and OsIMA2. Global gene expression analysis of rice under Fe-replete conditions showed that both rice IMAs were highly upregulated upon Fe starvation, pointing towards conserved functionality of IMAs across Fe acquisition strategies. Further, we observed that under Fe-limiting conditions root exudates from AtIMA OE

lines and also from M. truncatula can partially rescue the growth and development of Arabidopsis mutants harboring defects in the expression of F6'H1, a key enzyme in IMC biosynthesis, indicating a species-independent role of IMCs in maintaining nutrient homeostasis. Through this work, we aim to develop a bio-fortified rice variety, which can grow well in calcareous soil with high Fe content in grains. We would also like to engage the scientific community in investigating possible applications of IMCs as nutrient supplement for plants or designing intercropping strategies for better crop yield in soils with recalcitrant Fe pools.

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