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Category	: 8th Rice Genetics Symposium
Select Theme	: Genetic improvement
Endorsement email	:
Keyword 1	: Germplasm Enhancement
Keyword 2	: Genotype x Environment Interactions
Keyword 3	: Breeding Strategy
Title of Entry	: Rice MAGIC populations: genetics research and breeding for stress tolerance
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Select only one type of presentation	: 15 minute oral presentation
Abstract	: MAGIC (Multi-parent Advanced Generation Inter-Cross) is a breeding design that increases precision in mapping quantitative trait loci (QTL). The highly recombined MAGIC lines can also be used directly for the development of breeding lines and varieties adapted to different environments. The increased recombination in MAGIC populations can also potentially generate novel rearrangements of alleles and greater genotypic diversity. We have developed four MAGIC populations: indica MAGIC (8 indica founder parents); MAGIC PLUS (8 indica parents with two additional rounds of 8-way F1 inter-crossing); japonica MAGIC (8 japonica parents); and Global MAGIC (16 parents—8 indica and 8 japonica). Using 9,012 SNP markers, we estimated 87–100 recombinations per advanced inbred line of the indica MAGIC and indica MAGIC PLUS populations. Evaluation of two large populations (>1,300 lines) of indica MAGIC and Global MAGIC showed transgressive segregation in favorable agronomic traits. In addition, we have produced two trait-based MAGIC populations: Heat MAGIC adaptable to temperature fluctuations, and BioMAGIC enriched in biotic stress tolerance. Through genome rearrangements, new traits not present in the founder parents can be found in MAGIC populations. We have identified tolerance to stagnant flooding, strong germination under anaerobic conditions brown spot resistance, zinc deficiency tolerance, and high variation in amylose contents. In India and countries in Southeast Asia, we found adaptive MAGIC lines with grain yield higher than the local checks. We here present the applications of different MAGIC populations for genetic research and breeding for stress tolerance. Our results show that the MAGIC populations can serve as a permanent resource for QTL mapping and for direct and indirect use in variety development. Although new genotypic combinations can be generated by MAGIC, the source of alleles from the founders (8-16) is still limited. The 3,000 genomes data present an opportunity to select accessions with new diversity. We propose a strategy to combine allele mining and the MAGIC approach to introduce new allelic diversity into the MAGIC gene pools. This approach can simultaneously break up undesirable linkages and recombine favorable alleles. The resulting MAGIC populations with multiple traits in breeding-ready background can be a useful resource for rice breeding.

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