ABSTRACTS

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PL14

QTLs in rice breeding: examples for abiotic stresses

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Despite its status as a model agricultural crop and hundreds of studies identifying quantitative trait loci (QTLs), the applications of these results in rice breeding have been limited. However, the success of plant breeders in developing varieties with high yields, excellent grain quality and wide adaptation (i.e. mega-varieties) that are widely-grown by farmers, has provided an opportunity to deploy the most useful QTLs for rice improvement. QTLs with a relatively large effect can be transferred into mega-varieties, conferring a substantial improvement via marker assisted backcrossing (MAB). QTLs with large effect are rare for agronomic traits like yield, but are more common for other traits such as resistance to abiotic stresses, e.g submergence. Much of the tolerance in varieties such as FR13A has been shown to be under the control of the *Sub1* locus, which includes 2-3 tightly-linked putative transcription factors. *Sub1* was transferred into the Indian cultivar Swarna, resulting in a new version of this mega-variety with tolerance to submergence. Large QTLs also exist for tolerance to salinity, P deficiency, Al toxicity, and low temperature. With some modifications, this approach may be applicable for traits controlled by multiple smaller QTLs, such as tolerance to drought. However, strategies for transferring multiple QTLs into mega-varieties need to be developed such that negative effects of the transferred segments (linkage drag) do not adversely affect the resulting varieties. Furthermore, strategies for reducing costs associated with marker genotyping and efficient phenotyping also need to be developed and adopted in order to apply MAB on a larger scale.

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Fine-mapping of QTLs for agronomic traits

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Genomics-based strategies for the development of green super rice

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A number of challenges needs to be met in rice production for sustainable production and for reducing the gap between potential yield and the yield in large scale production: (1) increasingly severe occurrence of insects and diseases and the indiscriminate application of pesticides; (2) over-use of fertilizers; and (3) increasingly frequent occurrence of drought resulting in water shortage, as rice uses approximately 70% of the water used in agriculture in the entire country. We have been using a combination of approaches based on the recent advances in genomics research to address these challenges, with the long-term goal to develop rice cultivars referred to as "green super rice". On the premise of yield increase and quality improvement, green super rice should possess resistances to multiple insects and diseases, high nutrient efficiency and drought resistance, promising to greatly reduce the uses of the pesticides, chemical fertilizers and water. Most of the current efforts have been focused in identifying germplasm and discovering genes for improving rice