Jutarut Jantaboon 2012: Assessment of Stepwise Marker Assisted Selection in Combining Submergence Tolerance, Bacterial Blight Resistance and Cooking Quality Traits in Rice (*Oryza sativa* L.). Doctor of Philosophy (Plant Breeding), Major Field: Plant Breeding, Faculty of Agriculture at Kamphaeng Saen. Thesis Advisor: Mr. Theerayut Toojinda, Ph.D. 117 pages.

The aim of plant breeding is to develop superior genotypes by combining the desirable alleles from different sources. In the present study, submergence tolerance, bacterial blight resistance and cooking quality traits including fragrance, amylose content, gel consistency and gelatinization temperature are combined by marker assisted selection (MAS) to develop new rice varieties for rainfed and irrigated lowland ecosystems in the Mekong region. Stepwise selection approach (SSA) was used to minimize number of plants to be genotyped by DNA markers. Two breeding program were conducted including the cross between rice varieties IR57514 (IR) and KDML105 (KD) and the cross between RD6 and KDIII (KDML-*Sub1-Xa21-Bph*). In the first cross, a large population consisted of 2,037 recombinant inbred lines (RILs) was developed by single seed descent. Then MAS was conducted to identify the uniform offsprings that combined the desirable alleles from IR57514 and KDML105. Two ideotypes, ideotype1 (ID1; $Sub1^{IR}/badh2^{KD}/Wx^{KD}/SSIIa^{KD}$) and ideotype2 (ID2; $Sub1^{IR}/badh2^{KD}/Wx^{KD}/SSIIa^{IR}$) were selected as breeding target and selected lines were tested for trait performances by compared with those of the parents. All of the ID1 lines exhibited submergence tolerance and jasmine-like cooking quality and displayed a low amylose content, a fragrance and a high alkali spreading value, whereas the ID2 showed the same characteristics as ID1, except for a low alkali spreading value. A wide range of agronomic characteristics was observed in both of the ID groups, and some of the IDs were superior in the yield component, as compared to their parents. In the second cross, SSA was used for MAS since the F_2 generation until the F_6 generation. Two ideotypes, ideotype3 (ID3; $Wx^{RD6}/Sub1^{KDIII}/Xa21^{KDIII}$) and ideotype4 (ID4; $Wx^{RD6}/Sub1^{KDIII}/Xa21^{RD6}$) were selected as breeding target and selected lines were tested for trait performances by compared with those of the parents. All of the ID3 lines exhibited glutinous grain type, submergence tolerance and BB resistance, whereas the ID4 lines shown the same characteristic but susceptible to BB. This study provides further support that the precision of markers used in MAS can enhance the development of superior rice genotypes in which they combined all desirable alleles from the parents.

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