

<b>Title</b>	Improvement of RD 15 Rice Cultivar by Molecular Markers Assisted Backcrossing for Photoperiod Insensitive, Semi-dwarf and Glutinous Rice
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### ABSTRACT

This thesis was conducted to study the improvement of RD 15 rice cultivar for non-photoperiod sensitive, semi-dwarf and glutinous rice. RD 15 is a non-glutinous rice variety in Thailand with good cooking qualities. However, the plant is tall and photoperiod sensitive which carries homozygous dominant *Hd1Hd1Sd1Sd1WxWx* genotype. With the aid of functional markers, RD 15 variety was successfully improved by introgressions of the recessive *hd1*, *sd1* and *wx* genes from improved RD 6 line, which is non-photoperiod sensitive, semi-dwarf and glutinous, containing homozygous recessive *hd1hd1sd1sd1wxwx* genotype. Molecular markers assisted backcrossing (MAB) was applied in two backcrosses and one self-cross to select the four best lines of RD 15 containing genotype with corresponding phenotypes, namely: RD 15 NTN line (non-photoperiod sensitive, tall and non-glutinous with *hd1hd1Sd1Sd1WxWx* genotype), RD 15 NTG line (non-photoperiod sensitive, tall and glutinous with *hd1hd1Sd1Sd1wxwx* genotype), RD 15 NSN line (non-photoperiod sensitive, short and non-glutinous with *hd1hd1sd1sd1WxWx* genotype) and RD 15 NSG line (non-photoperiod sensitive, short and glutinous with *hd1hd1sd1sd1wxwx* genotype). These lines were then tested for photoperiod response under long-day condition of light exposure for 14 hours per day and were later checked for yield and other traits in field trials at Maejo University, Chiang Mai province, Thailand during the rainy season of 2010. Results showed that the selected four best lines of RD 15 showed flowering when the original RD 15 was not under

long-day condition. Nevertheless, grain yields and other most important traits such as number of seeds per panicle, fertility, weight of 1,000 seeds and characteristics of paddy and brown rice grain were not significantly different with the original RD 15 rice variety.

On the other hand, the study inheritance of photoperiod response, plant height and endosperm rice traits as controlled by *Hd1/hd1*, *Sd1/sd1* and *Wx/wx* genes using three markers (*hd1*, *sd1* and *wx*, respectively) in BC<sub>3</sub>F<sub>2</sub> population. A total of 150 BC<sub>3</sub>F<sub>2</sub> plants were planted in the greenhouse from August 2010 to March 2011 and exposed to light for 14 hours per day. Chi-square test ( $\chi^2$ ) was later applied for each individual gene. Results showed that genotypic and phenotypic ratios were found to follow the First Law of Mendel as shown by 107 non-flowering : 43 flowering plants, 110 tall : 40 short plants and 117 non-glutinous : 33 glutinous seeds ratios. Genetic analysis of these plants indicated that the rice plants were non-photosensitive with homozygous recessive *hd1hd1* genotype only; rice plants which were short, had homozygous recessive *sd1sd1* genotype only and rice seeds which were glutinous even when their plants had a homozygous recessive *wxwx* genotype only. Moreover, genetic inheritance in combination of two genes together was studied to analyze their genotypic and phenotypic ratios by chi-square test ( $\chi^2$ ), such as *Hd1/hd1* and *Sd1/sd1*; *Hd1/hd1* and *Wx/wx*; *Sd1/sd1* and *Wx/wx*. Results showed that both genotypic and phenotypic ratios followed the Second Law of Mendel. Furthermore, when combining three genes together such as *Hd1/hd1*, *Sd1/sd1* and *Wx/wx* genes, results also indicated that genotypic and phenotypic ratios followed the Tri-hybrid Cross.