

# SURVIVAL RATE UNDER SUBMERGENCE AND MOLECULAR GENOTYPING OF NEW RICE MUTANT VARIETIES NMR 151 AND NMR 152 USING SSR MARKER LINKED TO *SUB1* GENE

Faiz Ahmad<sup>1,2</sup>, Siti Norvahida Hisham<sup>1,2</sup>, Siti Nurdiyana Yusof<sup>1,2</sup>, Nor'Aishah Hassan<sup>3</sup>, Noraziyah Abd Aziz Shamsudin<sup>1</sup>, Noor Liyana Sukiran<sup>1</sup>, Affrida Abu Hassan<sup>2</sup>, Sobri Hussein<sup>2</sup>, Abdul Rahim Harun<sup>2</sup>

<sup>1</sup>Department of Biological Sciences and Biotechnology, Faculty of Science and Technology, Universiti Kebangsaan Malaysia, 43600 Bangi

<sup>2</sup>Agrotechnology and Biosciences Division, Malaysian Nuclear Agency, Bangi, 43000, Kajang, Selangor.

<sup>3</sup>Faculty of Applied Science, Universiti Teknologi MARA, Cawangan Negeri Sembilan Kampus Kuala Pilah, Negeri Sembilan, Malaysia

## INTRODUCTION

Flooding is a serious, naturally occurring problem for rice production in the rainfed lowlands of south and south-east Asia during the monsoon season. Additionally, about 20 million hectare of rice field in Asia were affected due to flooding (Ismail *et al.*, 2013). Submergence tolerance is referring the ability of the plant to grow after being completely submerged in water for several days. Rice plants are less tolerant to submergence at early growth stages (Adkin *et al.*, 1990). However, in recent years, researchers had found a way to evade this problem by screening *SUB1* gene which makes seeds or seedlings tolerance towards the submergence during flash floods. In Malaysia, lacking of new high yielding rice varieties with submergence tolerant trait is one of the problem facing by our rice industry player (Welland *et al.*, 2017). Evaluation of high yielding rice genotypes derived from the breeding program to submergence tolerant and identification presence of *SUB1* gene is crucial to select promising genotypes to be introduced in flood prone-area.

## OBJECTIVE

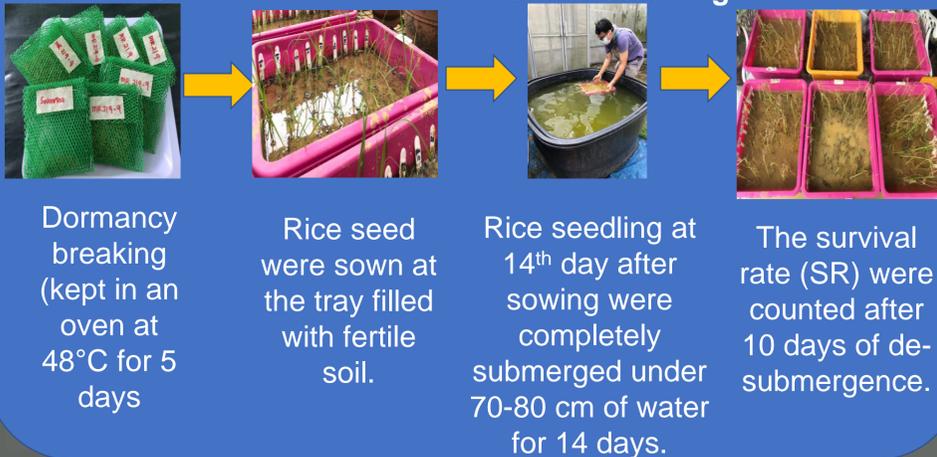
The objective of this research are i) to determine survival rate under submergence and ii) to confirm the presence of *SUB1* in both mutant rice cultivars.

## METHODOLOGY

### Plant Materials

Three selected rice mutant lines developed from Malaysian Nuclear Agency namely, NMR 151, and NMR 152, together with submergence susceptible genotypes, MR 219 (negative check) will be used in this research respectively. The submergence tolerant rice variety which is IR64 *Sub-1* will be used as positive check.

### Survival Rate evaluation Under Submergence



## RESULTS AND DISCUSSION

### Survival Rate evaluation Under Submergence

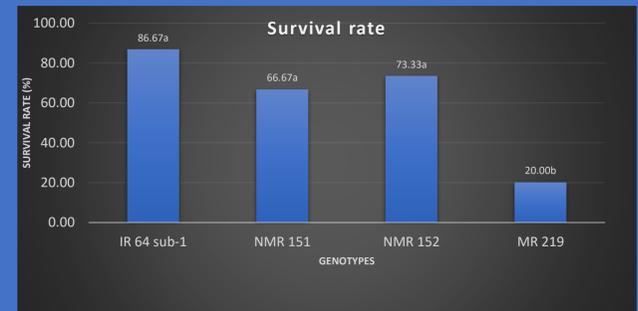


Figure 1: Survival rate of all genotypes tested under 14 days of submergence

The results showed high variation of survival rate under 14 days of submergence (20 to 86.67%). Positive tolerant check genotype, IR64 *sub-1* showed higher survival rate (86.67%) among the genotypes. Two rice mutant genotypes, NMR 151 and NMR 152 showed higher survival compared to susceptible genotypes, MR 219.

### Genotyping Using SSR Markers Linked to *SUB1* Gene



Figure 2: PCR product after amplification using SSR marker linked to *SUB1* gene viewed under 3% metaphor agarose gel

The results showed that both mutant varieties, NMR 151 and NMR 152 were not amplified *SUB-1* alleles. This indicates that the submergence tolerance trait in both mutants rice was controlled by genes other than *SUB1*.

## CONCLUSION

Two mutant rice varieties, namely NMR 151 and NMR 152 showed survival rate more than 60% under submergence stress condition. These 2 new rice mutant varieties have been potential to be planted in flood prone area. Besides, absence of *sub-1* alleles indicate the other gene controlled submergence tolerant traits in these two mutant varieties. Further studies to identify QTL's controlled the submergence traits in this two new rice mutant varieties is very promising.

## ACKNOWLEDGEMENT

The authors would like to thanks to the Ministry of Higher Education for providing research grant under FRGS grant (FRGS/1/2019/WAB01/MOSTI/02/1). Special acknowledge to International Atomic Energy Agency (IAEA) for support in term of training and capacity building, Malaysian Nuclear Agency (MNA) and Universiti Kebangsaan Malaysia (UKM) for providing research facilities. Special thanks also to Civil Service Department of Malaysia (JPA) for provided his scholarship under Hadiah Latihan Persekutuan (HLP).

### Genotyping Using SSR Markers Linked to *SUB1* Gene

- Five SSR marker tightly linked to *SUB1* gene (SC3, ART 5, RM 23662, RM 23887 and RM 5688) were used in this study.

