

UNIVERSITI TEKNOLOGI MARA

**ASSESSMENT OF DROUGHT-
TOLERANT CHARACTERISTICS OF
GAMMA IRRADIATED RICE
VARIETY MR263 *IN VITRO***

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MSc

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AUTHOR'S DECLARATION

I declare that the work in this dissertation was carried out in accordance with the regulations of Universiti Teknologi MARA. It is original and is the results of my own work, unless otherwise indicated or acknowledged as referenced work. This dissertation has not been submitted to any other academic institution or non-academic institution for any degree or qualification.

I, hereby, acknowledge that I have been supplied with the Academic Rules and Regulations for Post Graduate, Universiti Teknologi MARA, regulating the conduct of my study and research.

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ABSTRACT

Fluctuating weather conditions and climate change are affecting agricultural productions worldwide including rice yield. Combined with the increasing population and decreasing land space for agricultural practices, biotechnological solutions are needed to improve the livelihood of farmers and the country's food security. Malaysian rice variety MR263 is a popular lowland white rice which is susceptible to drought. This study was conducted to assess the characteristics of gamma irradiated rice variety MR263 that were tolerant to drought stress induced by polyethylene glycol 6000. The seeds were gamma irradiated with doses 300, 350 and 350 Gy. Using *in vitro* tissue culture, they were germinated on MS media, and the seedlings were introduced to drought by the addition of 10% and 20% PEG 6000. It was found that the germination percentage was highest in the control seeds (100%) and lowest in the 400 Gy irradiated seeds (62.6%). Shoot lengths reduced with radiation dose, and so did the root lengths and fresh and dry weights per treatment. The root lengths showed major increase at dose 350 Gy compared to the other treatments at 10% PEG. Fresh and dry weights generally decreased with dosage and water stress levels. The highest fresh and dry weights improvement was observed in seedlings irradiated with 350 Gy. The proline content increased as the radiation doses and PEG concentrations increased with the highest value being $11.8 \pm 0.67 \mu\text{M/g}$ in the seedlings treated with 300 Gy and 20% PEG and the lowest value being $1.3 \pm 0.73 \mu\text{M/g}$ in the control seedlings. The levels of carbohydrates in irradiated seedlings sharply increased compared to the control seedlings at normal water levels, but did not drastically change with gamma radiation and PEG. The least performance in terms of growth and development was observed at 300 Gy; this dose might have been too low to make substantial enhancement in the traits of MR263. It was concluded that the seedlings which stood out amongst all were those treated with 350 Gy, as they had the highest values of shoot and root lengths, fresh and dry weights and proline levels. This treatment was deemed optimal to produce rice seedlings which are tolerant to drought stress.

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