

Germination, Physiochemical, and Morphology Changes of TR10 Rice Seeds Irradiated to Filtered and Unfiltered Neutron

ABSTRACT

In 2020, Sabah's rice production was 117, 846 metric tonnes with a planted area of 40, 446 ha is relatively low compared to other states such as Selangor, which has 36,004 ha less planted area but can produce up to 159,535 metric tonnes more than Sabah. Low rice production in Sabah has contributed to the shortage of supply. Thus, new varieties could be needed that sufficiently produce yields that comparable to the efforts and cost of rice planting. One of the methods is producing new varieties that probably produce high yields using physical mutagen. From the literature available, gamma and neutrons were found to be the most common agents to increase rice production per unit planting area but used they were used separately. Theoretically, using fast neutron irradiation was found to produce a superior mutant. Thus, this paper aims to study the effect of rice seeds irradiated to both gamma and neutron simultaneous and compare with neutron alone on the germination rates and physiochemical of rice seeds after the irradiations at different dosages. TR10 rice seeds were irradiated simultaneously to gamma and neutrons in the nuclear reactor core using Pneumatic Transfer System–PTS facility, while irradiation to neutrons alone was performed in a neutron chamber using Beam ports–BP facility at Nuclear Malaysia. The germination study shows a linear decrease as the irradiation doses increase in BP and fail to germinate in PTS. Yet, seeds irradiated in PTS showed no hazardous compounds and a remarkable increase in mineral content in seeds, particularly potassium and magnesium at 14 Gy. Similarly, to the shape of the starch granules in both facilities, the starch structure changes after being exposed to 14 Gy in PTS and 35 Gy in BP. As a result, seeds exposed to neutron alone induced considerably more inclusive effects and may raise growth performance and improve rice quality with optimal neutron dosage range from 7 to 14 Gy.