

A systematic review on physical mutagens in rice breeding in Southeast Asia

ABSTRACT

In the 1920s, Lewis Stadler initiated the introduction of permanent improvements to the genetic makeup of irradiated plants. Since then, studies related to breeding mutations have grown, as efforts have been made to expand and improve crop productivity and quality. Stadler's discovery began with x-rays on corn and barley and later extended to the use of gamma-rays, thermal, and fast neutrons in crops. Radiation has since been shown to be an effective and unique method for increasing the genetic variability of species, including rice. Numerous systematic reviews have been conducted on the impact of physical mutagens on the production and grain quality of rice in Southeast Asia. However, the existing literature still lacks information on the type of radiation used, the rice planting materials used, the dosage of physical mutagens, and the differences in mutated characteristics. Therefore, this article aims to review existing literature on the use of physical mutagens in rice crops in Southeast Asian countries. Guided by the PRISMA Statement review method, 28 primary studies were identified through a systematic review of the Scopus, Science Direct, Emerald Insight, Multidisciplinary Digital Publishing, and MDPI journal databases published between 2016 and 2020. The results show that 96% of the articles used seeds as planting materials, and 80% of the articles focused on gamma-rays as a source of physical mutagens. The optimal dosage of gamma-rays applied was around 100 to 250 Gy to improve plant development, abiotic stress, biochemical properties, and nutritional and industrial quality of rice.