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HISTORY OF MUTATION BREEDING AND MOLECULAR RESEARCH USING INDUCED MUTATIONS IN JAPAN

Following the construction of the Gamma Field at the Institute of Radiation Breeding (IRB) in 1960, mutation breeding was accelerated in Japan. The facility is used to induce mutations by applying a higher radiation dose (up to 2 Gy/day: ca. 300,000 times that of natural background) and at a higher frequency than occurs in nature. There have been 295 direct-use mutant cultivars representing 70 species generated through irradiation utilizing gamma-rays, X-rays, ion beams and chemicals and somaclonal variation. Approximately 79% of these direct-use cultivars were induced by radiation. There have been 335 indirect-use mutant cultivars, including 298 rice, of which 150 cultivars (50.3%) were derived from the semi-dwarf mutant cv. "Reimei". The economic impact of these mutant cultivars, primarily of rice and soybean, is hugely significant. Some useful mutations are discussed for rice, such as low digestible-protein content, low amylose content, giant embryo and non-shattering. Useful mutations in soybean such as radio-sensitivity, fatty acid composition, lipoxygenase-free, glycinin rich and super-nodulation have been identified. The achievements of biological research include the characterization and determination of deletion size generated by gamma-rays, the effect of deletion size and genomic location and gene function. Genetic studies generated through the use of gamma-ray induced mutations include: phytochrome research, aluminium tolerance and epicuticular wax. Mutation breeding is a very interesting and useful technology for isolating genes and for elucidating gene functions and metabolic pathways in various crops. Records show that mutation induction is a very useful conventional breeding tool for developing superior cultivars. The IRB is well equipped with appropriate facilities and equipment that will contribute to future mutation breeding developments and it will be a contributor in solving various genomic, proteomic and metabolic problems.

Country or International Organization

Japan

Author: Dr NAKAGAWA, Hitoshi (Hamamatsu Photonics K.K.)

Presenter: Dr NAKAGAWA, Hitoshi (Hamamatsu Photonics K.K.)

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