

# FAO/IAEA International Symposium on Plant Mutation Breeding and Biotechnology



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## Mapping the Landscape of Gamma and X-ray-induced Mutations in Rice

Crop monocultures and the disappearance of small-farms is having a negative impact on the genetic diversity used in global agriculture. Enhancing agrobiodiversity plays a key role in adapting to a changing climate and feeding future generations. Expanding genetic diversity through induced mutagenesis is highly successful with thousands of improved varieties released worldwide. Advanced molecular techniques such as massively parallel sequencing opens new opportunities to accelerate crop mutation breeding. While X-ray irradiation was the first mutagen employed to induce novel genetic variation in the 1920s, treatment with gamma-rays had become the predominant physical mutagen for crop mutation breeding by the middle of the 20th century. To explore why physical mutagens have been so effective in breeding we investigated the landscape of mutations induced by gamma and X-rays in a rice landrace from Madagascar, Marotia. Eleven mutant lines advanced via self-fertilization for 7 generations were sequenced using a HiSeq Illumina platform. We have identified a broad spectrum of mutations including SNPs, small INDELS, and larger structural variants. Overall, thousands of putatively induced SNP's and INDELS were identified across all mutant lines. Over 80% of these mutations were located within intergenic regions while in case of SNPs and INDELS, only 0.1% and 2% are predicted to impair the function of genes, respectively. Interestingly over 90% of the large deletions (>150 bp) mapped to transposons within the reference genome. Approximately 40% of randomly selected putative SNPs, INDELS and large structural variants could be validated as radiation-induced mutations using standard PCR and Sanger sequencing. Overall, our study shows that (1) X-ray and gamma rays induce similar spectra and frequency of mutations, predominately SNPs and small INDELS; and (2) points towards an important role for transposons in radiation-induced mutagenesis.

### Country or International Organization

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