

B-133

Molecular studies of mutations induced by proton beam irradiation in soybean using genotyping-by-sequencing

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Ionization radiation causes DNA single strand breaks (SSB), double strand breaks (DSB), damage or loss of bases, and intramolecular / intermolecular crosslinking. Since there is no report on the mutation rate according to the proton beam irradiation in soybean, the present study investigates the genetic variation in the soybean chromosome induced by the proton beam irradiation. Total of 22 plants including each 10 M2 plants induced from 118Gy and 239Gy of proton beam, respectively, and 2 wild-type plants (Deapungkong) were sequenced using GBS technology. Total of 7,453 SNPs were observed in proton beam irradiated M2 plants. Of these, 3,569 SNPs were observed in the genic regions. Among 5,829 union SNPs, transition and transversion were 47% and 53%, respectively. The highest substitution ratio was for transversion A / T with 37%. Most SNPs (82%) were distributed in one gene, while the rest (12%) had 2 to 5 SNPs per gene. The SNPs induced by proton beam were uniformly distributed in most of the chromosomes. This study will establish a framework for constructing a pool of mutant genetic resources using the proton beam.