3 - 46 Damage Effect of Carbon Ion Beam Irradiation on Sweet Sorghum

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It is well known that ion beams have dramatic mutagenic effects[1]. The reason why heavy ions are more suitable for induced mutagenesis is well explained by Liu et al and Tanaka, et al.[2-3]. Liu et al think that energetic ions can penetrate through the seed coat and cell envelope and induce strand breaking of the DNA. Tanaka et al highlight that more than the mutation rate per dose, the number of mutations should be considered for the most suitable mutagen selection. As feedstock for fuel ethanol, sweet sorghum [*Sorghum bicolor* (*L.*) *Moench*] is a C4 plant characterized by a high photosynthetic efficiency and a high biomass- and sugar- yielding crop[4]. However, the current varieties of sweet sorghum are not suitable for bio-ethanol production because of its low sugar content. In this study, the dry seeds of equal size of sweet sorghum were irradiated by carbon ion beam in order to create novel germplasm resourses and breed the excellent variety, the irradiation energy being 100 MeV/u and the dose rate being 20 Gy/min. The results revealed that the physiological damages increased as the irradiation dose increased when the seeds of sweet sorghum were irradiated by carbon ions with doses of 120, 160, 200, 240 Gy. As shown in Fig. 1, the seedling growth was obviously retarded when the dose was 200 and 240 Gy. The analysis of DNA mutation rate showed that the maximum value was 18.95% at 200 Gy, whereas the mutation rate decreased at 240 Gy, the value being 17.87%(Fig. 2).

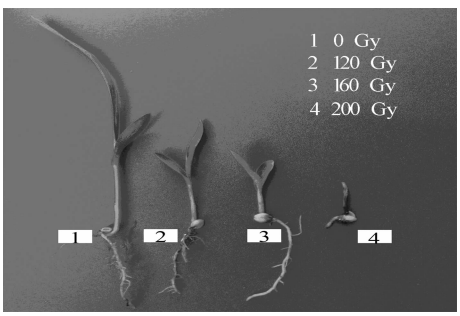

Fig. 1 Effect of carbon ion beam irradiation on sweet sorghum seeds with different doses.

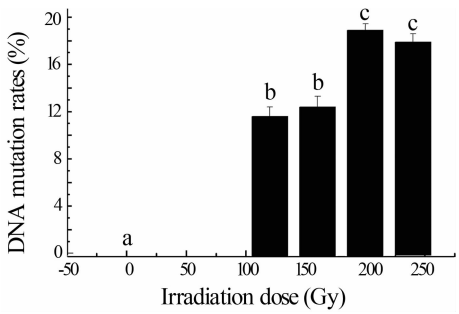

Fig. 2 DNA mutation rates detected by RAPD technique after carbon ion irradiation in sweet sorghum.

It is generally thought that heavy ion beam induces more complex DNA damage[5], which this damage is more difficult for the cell to repair and that in turn lead to more severe consequences[6]. Our results revealed that drastic differences were detected between non-irradiated treatment and irradiated treatments at 120, 160 and 200, 240 Gy of carbon ion beam for DNA mutation rates. Nevertheless, there was no significant difference between 120 and 160 Gy, so was irradiation treatments of 200 and 240 Gy (Fig. 2). Taken together, 200 Gy irradiation dose triggered the highest mutation rate and less physiological damage, which would be regarded as the optimal dose in the future. In conclusion, various irradiation doses caused DNA damage of different degree.

References

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