

Improvement of the Brix content of the sweet potato “Anno-Beni” by mutation induced using heavy-ion-beam irradiation

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Heavy-ion-beam irradiation effectively induces plant mutations and is used for plant breeding.¹⁾ The sweet potato cultivar “Anno-Beni,” which has a high sugar content, is an important and special product in the Tanegashima island area. However, the weather can cause the sugar content to be unstable and the product to taste bad. Sugar is produced from starch by storage and heat, and it turns into sweetness. However, the dry-matter content and starch content change according to the harvest time, storage period, and tuber root position. Therefore, by inducing mutations through heavy-ion-beam irradiation, varieties and strains with a stable sugar content have been selected. In this study, we measured the dry-matter contents of selected mutants irradiated with a heavy-ion-beam, and in this report, we describe the effect of the irradiation on the sugar content.

Embryogenic callus derived from the stem apex of the “Anno-Beni” B1 line were irradiated with a C-ion-beam (LET 23 keV/ μm) at a dose of 5, 10, and 15 Gy in 2015. Regenerated plants that grew normally were obtained from the irradiated callus. Subsequently, we propagated 196 individual plantlets to 5 clone plants, respectively, and cultivated them in the field of KIAD * 1, Kumage Branch for line selection in 2016. We selected 31 lines that grew better and had higher dry-matter contents than the control (Table 1).

In the next year, the 31 selected lines were grown by vegetative propagation, and 5 individual plants per line were cultivated in the field. We investigated the plant growth and dry-matter contents in 2017. The root tubers of the 4 lines were steamed and, diluted with water in a 1 : 1 ratio, their Brix contents were measured. Brix is the sugar content of an aqueous solution. It is known that there is a correlation between the dry-matter rate and Brix percentage of tuberous roots in sweet potato.²⁾ Although the means of the dry-matter content in 4 mutant lines showed no significant difference, the Brix contents of 4 lines were higher than those of the control (Table 2).

Some root tubers produced by mutant lines had a higher Brix percentage and dry-matter rate than the control (Fig. 1). These results, obtained through the individual selection of mutant lines showing better growth and higher dry-matter contents than the control, suggest that high-Brix-content strains could be selected.

Table 1. Line selection by dry-matter ratio of mutants of the sweet potato “Anno-Beni” obtained by C-ion-beam irradiation.

Dose (Gy)	Number of regenerated shoots	Number of selected plants
5	107	25
10	70	5
15	19	1

Table 2. Dry matter and Brix content of 4 mutant lines of sweet potato.

Line name	Dose (Gy)	Tested root tubers	Mean of dry matter ratio (%)	Mean of brix (%)
No. 15	5	7	34.3	12.4
No. 17	5	7	34.1	12.7
No. 27	5	5	35.9	13.0
No. 34	10	5	36.0	13.2
Control (B1)	-	16	33.3	11.6

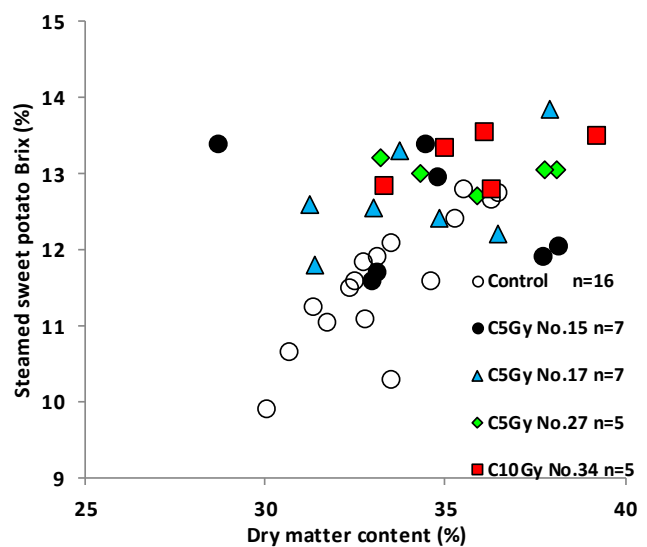


Fig. 1. Correlation between Brix content and dry-matter ratio in root tubers produced by 4 mutant lines.

References

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