

Producing high brix content of the sweet potato Anno-Beni by mutation induced using ion-beam irradiation

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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 exquisite product in the Tanegashima island area. There has been a high demand for Anno-Beni with a high brix content that remains stable. The dry-matter contents and brix contents in the sweet potato are correlated.²⁾ Therefore, by inducing mutations through ion-beam irradiation, lines with higher dry-matter contents and higher brix contents can be selected. In a previous report, we described 31 lines selected from the population of the Anno-Beni B1 line irradiated with a C-ion-beam.³⁾ This report describes the results of the continued selection.

In 2017, five lines with better growth and higher dry-matter contents than those of the control were selected from 31 lines.

In 2018, the five selected lines were cultured at the shoot apex to produce 20 lines. The 20 lines were grown by vegetative propagation, and five individual plants per line were cultivated in the field. We selected four lines that grew better and had higher dry-matter contents and higher brix contents (0.8–3.2 and 2.0–2.9, respectively) than the control (Table 1).

In 2019, the four lines were grown by vegetative propagation, and 30 individual plants per line were cultivated in the field. The four lines that grew better and had higher dry-matter contents and brix contents (2.4–4.1 and 1.1–2.4, respectively) than the control (Table 1).

The four lines had 22–35% lower yield contents than the control. The shapes of the tuberous roots were spindle to cylindrical for the control and No.36-2, whereas it was long-spindle to cylindrical for No.19-1, No.19-4, and No.20-2 (Fig. 1).

Table 1. Dry-matter and brix contents of four mutant lines of sweet potato.

Line name	Dose (Gy)	Mean of dry matter ratio (%)		Mean of brix (%)		2019 Mean of yield	
		2018	2019	2018	2019	(Kg/a)	Control ratio
No. 19-1	5	33.6	37.8	14.0	14.1	278	(78)
No. 19-4	5	36.0	38.6	14.7	14.7	271	(76)
No. 20-2	5	35.0	39.5	14.4	13.4	274	(77)
No. 36-2	15	34.9	38.2	13.8	14.1	232	(65)
Control (B1)	–	32.8	35.4	11.8	12.3	356	(100)

1) The tuberous roots of the four lines were steamed and diluted with water in a 1:1 ratio. Subsequently, their brix contents were measured.

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Fig. 1. Tuberous roots of the four lines and control.

- 1) Control (upper), No.19-1(lower left end), No.19-4 (lower left center), No.20-2 (lower right center), No.36-2 (lower right end).
- 2) Harvested on September 17, 2019 (planting period:132 days).

Table 2. Evaluation results of four mutant lines of sweet potato.

Line name	Dose (Gy)	Mean of sweetness		Mean of flesh color		Mean of aroma		Mean of stickiness	
		3 days later	1 month later	3 days later	1 month later	3 days later	1 month later	3 days later	1 month later
No. 19-1	5	0.4	0.9	-0.6	-0.4	-0.4	0.2	-0.7	0.1
No. 19-4	5	0.2	0.5	-1.1	0.5	-0.2	0.0	-1.0	0.2
No. 20-2	5	0.5	0.4	-0.5	-1.0	-0.1	0.1	-0.7	-0.6
No. 36-2	15	0.2	1.1	-0.5	-0.1	0.0	0.3	-0.6	0.2
Control (B1)	–	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

- 1) The evaluation scores were in the order of -3,-2,-1, 0, 1, 2, 3 from the lowest score.
- 2) Mean of 13 evaluations after three days and 10 evaluations after one month.

The four lines were examined for taste survey after three days and after one month of storage (Table 2). The sweetness of the four lines was higher than that of the control after one month. The flesh color of No.19-1, No.20-2, and No.36-2 was lighter than that of the control after one month. The aroma of the four lines after storage for one month were almost equal to that of the control. The stickiness of No.19-1, No.19-4, and No.36-2 were equal to that of the control after storage for one month. The sweetness, flesh color, aroma, and stickiness tended to increase after storage for one month. By selecting the dry matter rate from ion-beam irradiated postgrowth, we were able to select lines with high brix contents and a sweet taste.

References

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