# Mutation induction in strawberry of original Saitama cultivar by C-ion irradiation

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Agriculture in Saitama prefecture is in a poor situation owing to the aging of producers and the decrease in the number of new farmers. Strawberry is one of the important farm products of Saitama because of its high productivity per unit area. We have been working on the breeding of strawberry since 2008 to enhance the production of strawberry. We successfully produced our original cultivars "Saien I-1Go" and "Saien I-3Go"[1] and registered them in February 2019. These cultivars have a rich taste with high sugar content and moderate acidity, as well as a good balance between sweetness and acidity. Therefore, the production of these cultivars is expected to expand in the near future. On the other hand, they have the disadvantaged of a late harvest period and low yield compared to general main varieties. In addition, the peel color of "Saien I-3Go" darkens in the warm season, which results in a reduced evaluation of the fruit appearance. To solve these problems, we conducted mutation breeding by using heavy-ion beams and are in the process of developing promising lines with improved yield factors such as an increased number of fruit sets, an earlier harvesting season, and a desirable peel color.

We used "Saien I-1Go" and "Saien I-3Go" for irradiation from 2015 to 2018. The seedlings were irradiated with C-ion beams (LET 22.5 keV/$\mu$m) at dose ranges of 10–30 Gy, 30–80 Gy, and 30–120 Gy in 2015–2016, 2017, and 2018, respectively. After irradiation, seedlings were grown by cuttings. The survival rate was measured after 4 to 5 weeks, and the growth and changes in peel color were observed after planting. Selected mutant lines were propagated in a runner plant, and the stability of mutant traits was confirmed in the next year.

Table 1. Survival rate of "Saien I-1Go" and "Saien I-3Go."

| Dose (Gy) | Survival rate (%) | |
|---|---|---|
| | Saien I-1Go | Saien I-3Go |
| 0 | 100.0 | 100.0 |
| 30 | 90.7 | 93.2 |
| 40 | 92.8 | - |
| 60 | 78.3 | 61.9 |
| 80 | 60.0 | - |
| 90 | - | 26.4 |
| 120 | - | 4.4 |

"Saien I-1Go" in 2017, and "Saien I-3Go" in 2018
The number of surviving plants was counted 4 ("Saien I-1Go") or 5 ("Saien I-3Go") weeks after irradiation.

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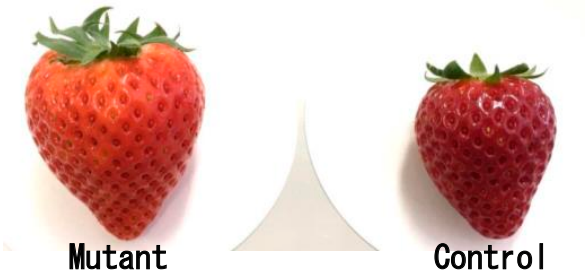


Fig. 1. Peel color of a mutant of "Saien I-3Go" irradiated at a dose of 30 Gy.


Fig. 2. High-branching mutant of "Saien I-1Go" irradiated at a dose of 80 Gy.

According to the result, both "Saien I-1Go" and "Saien I-3Go" survived even at a dose of 80 Gy or more. A previous study showed that the lethal dose 50 of C-ion irradiation for apple and Japanese pear scions are 18 Gy and 13 Gy, respectively.[2] This suggests that the seedlings of strawberry may be a viable plant species even at high irradiation doses relative to those of other plants of the family Rosaceae (Table 1).

We obtained several mutant lines in this study. One of these mutant lines changed the peel color from dark red to light red (Fig. 1). Another line increased the number of branches and flowers owing to abnormal branching morphology (Fig. 2). We are currently investigating the other characteristics of these promising mutant lines, such as the grass shape, flowering time, and yield. We are also investigating whether the target trait is inherited in progeny and examining whether it is promising as a breeding stock.

The peel color of the mutant is lighter than that of the control.

The number of branches and flowers increased in the mutant.

References

1) H. Oda *et al.*, Bulletin of the Saitama Agricultural Technology Research Center. jpn. **17**, 7 (2018).
2) Y. Ito *et al.*, RIKEN Accel. Prog. Rep. **37**, 151 (2004).