

Breeding Strategies to Control on Occurrence of Double Ovules Fruit in Monogerm Sugar Beet

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Summary

A mixture of double ovules (poly ovules) fruit which including two or more true seeds (ovules) in a seed canopy of genetically monogerm variety is a undesirable character for monogerm sugar beet (*Beta vulgaris* L.) production. Double ovules fruit creates an additional work of thinning as bigerm fruits does. Recently a number of hybrid varieties with high double ovules rates were found existed. In the present study, in order to develop varieties with high monogermity, genetic behavior of double ovules trait was analyzed to make use of individual selection utilizing foreseeable genetic variations, and the relationship between double ovules trait and other traits relating to seed production by using O-type lines mainly.

The soft X-ray method as a substitute for the anatomic method was tested for confirming double ovules. The transmission rate of soft X-ray was high enough to identify the number of ovules in fruit, although it was a little lower than that obtained by the anatomic method. There was highly positive correlation in double ovules rate between soft X-ray method and anatomic method, and the soft X-ray method was found more efficient in testing fruits than the anatomic method.

It was shown that the mother population of a self fertilized O-type line "NK-183mm-O" had a large and continuous variation in double ovules rate. The progenies selected from this population were fixed on the high, middle and low double ovules rates. The standardized heritability was about 0.55, and showed no differ-

ences between high and low selection. From these results, it was concluded that double ovules rates of monogerm sugar beet were controlled by poly gene system, and by individual selection it was possible to develop the lines with genetically different double ovules rates. But by individual selection from "NK-183mm-O" it was impossible to develop the line with low double ovules rate under 5%. F₂ populations developed by line crosses between the progenies of "NK-183mm-O" and no double ovules rate line "NK-195mm-O" distributed continuously from the mid-parent. From these F₂ populations O-types with low double ovules rates under 5% and high sugar yield were developed by individual selection. And also from the pedigree studies about double ovules traits in O-types, it was found that high double ovules rates were introduced from the TA-5-O used as the origin of self fertility.

In terms of F₁ seed parents of the three way top cross hybrid, double ovules rates were shown to approximate to the mid-parent value of CMS and O-type lines used as parents. From this experiment the F₁ seed parent with high monogermity, "(NK-195mm-CMS × NK-280mm-O)" was selected, and by using this line, a new three way top cross hybrid having high sugar yield, "Hokkai 84" was developed.

There was no correlation between double ovules and bigerm rates in the O-types. And also the occurrence of double ovules in bigerm fruits was much the same way as monogerm fruits. It was considered that because the double ovules trait was independent of the shape of fruit,

the monogerm sugar beet with no double ovules and bigerm fruits could be developed.

From the study of distribution of double ovules fruits in various branch location of an individual plants, it was made clear that the higher the branches located above the ground, the more the double ovules fruits were increased, and the primary branch had more double ovules fruits than the secondary branch. Thousand kernel weight increased with the double ovules fruits increased, and the plants had lower double ovules rates, the each of branch locations showed lower rates. And also the double ovules fruits were

distributed a few on the tip part of an each branch. From these results, it was suggested that the formation of double ovules fruits were closely related to the degree of fruit and ovule development depending on the flowering order controlled by an indeterminate inflorescence at each branch of sugar beet plant.

The findings in these studies revealed that many new information was obtained concerning the double ovules fruits in sugar beet, and that breeding for a new variety with a fewer double ovules fruits became possible.