# NEW METHODS FOR SUGAR BEET STARTING MATERIAL DEVELOPMENT

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## INTRODUCTION

Plant breeding occupies a central place in agricultural production intensification. In the present stage, progress in sugar beet breeding is not possible without using new techniques and methods of work.

Usage of experimental radiation mutagenesis is highly promising for breeding process because it allows not only to control plants growth and development to increase their productivity but also to produce different genotypes that can be a source of valuable recombinants with new gene interaction much faster than under natural conditions. Such genotypes can be starting material for development of different valuable lines.

Hybridization with the help of irradiated pollen is the most promising technique of experimental mutagenesis considerably increasing progeny diversity. Depending on the aims of breeders, artificial pollinations with irradiated pollen can be used to quicken forming processes and to overcome self- and cross incompatibility as well as to produce heterosis hybrids of higher productivity.

## METHODS AND MATERIALS

Sugar beet samples taken from plant collections of All-Russian Institute of Plant Cultivation, Lgovskaya Experimental Breeding Station, All-Russian Research Institute of Sugar Beet and Sugar were used in this work. Among the presented samples of different origin, male sterile plants were used as mother component. Pollen taken from wild beet species – *B. corolliflora L.* (2n=36), *B. trigyna L.* (2n=54), and marked testers – *Carter's long red*, *Lange schwarzrote* (2n=18), were used as farther component. Pollen of the pollinator was exposed to rays of *PXM-γ-20* gamma-ray source with $Co^{60}$ radiant in dose from 1 to 3500 Gr.

## RESULTS AND DISCUSSION

It is well known that to obtain a great number of male sterile lines and fixing sterility pollinators of the so-called O-type is necessary for sugar beet hybrid breeding using cytoplasmic male sterility.

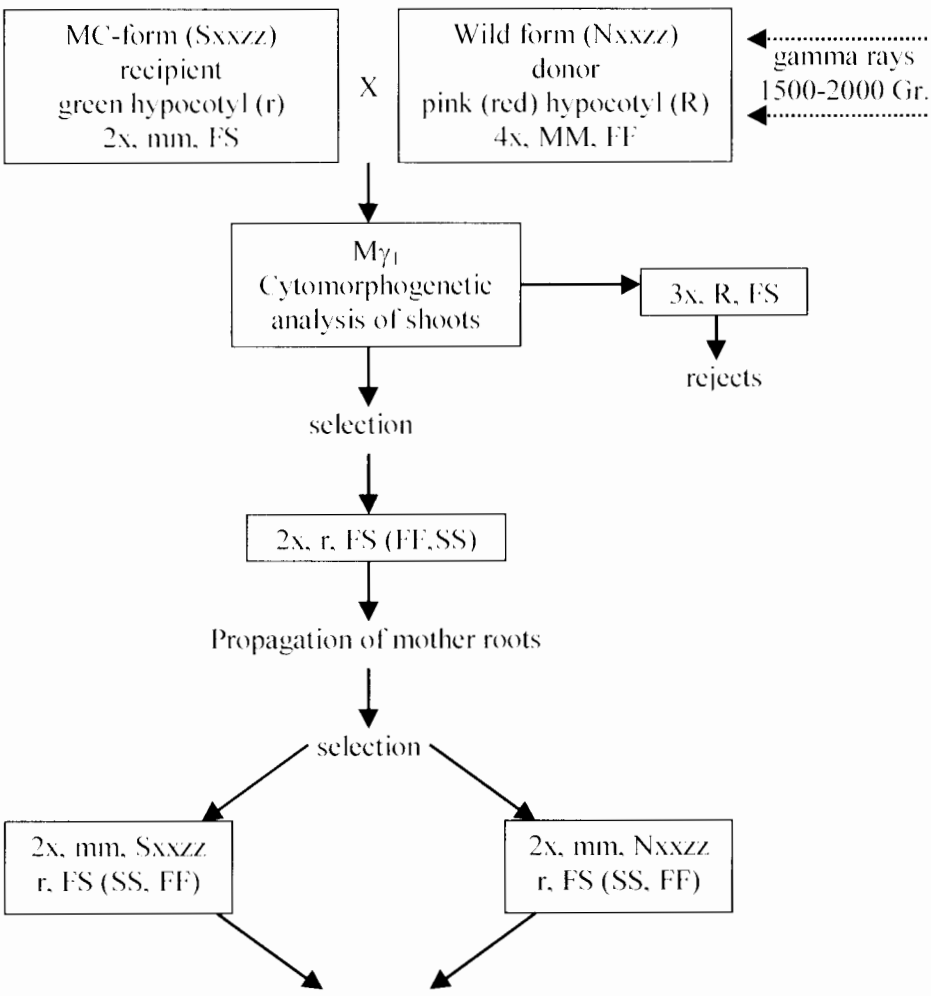
Non-typical methods for development of such lines based on mutations using, especially in introgression when traits of a species are transferred to another one, have been widely spread during last years. Dosed gamma-radiation pollen

treatment of different species pollinators has become one of the ways for sugar beet lines obtaining.

Indispensable condition of induced pollinations is biochemical gene marking based on co-dominant type of isozyme inheritance in parent pairs and selection of initial forms by contrast morphological traits.

The method of rapid homozygous gamma-lines obtaining developed in our Institute has allowed to obtain fixing CMS gamma-lines of O-type and their MS-analogues that are diploid gamma-induced apomictic lines as well as gamma-lines with recombinant genes of rather high monogermity level (98-100 %) (Fig. 1).

*Fig. 1 Scheme of sugar beet gamma-induced lines obtaining (Beta vulgaris L.)*



In our investigations, the quantity of self-fertile plants isolated from $M\gamma_1$ gamma-induced progeny appeared to be the greatest in pollinations with pollen of wild beet *B. corolliflora* (2n=36) exposed to rays in dose 100-1500 Gray and was 45,3-52,6 %, accordingly. According to Balkov's and other investigators' data of experiments (1976-1990), frequency of occurrence of self-fertile forms in sugar beet usually did not exceed 1 %.

Some authors (Maletskaya, 1994; Seilova, 1996) think self-fertility to be connected with apomixis that makes this trait invaluable when fixing heterosis in sugar beet.

Self fertile gamma-lines obtained by us were 100 % fixing sterility and had high level of monogermity, high seed productivity, root mass (635-900g) and sugar content of 18,2-20,5 %.

According to Pandey hypothesis (1980), selection of self-fertile plants in $M\gamma_1$ progeny was carried out according to self-fertility gene "transformation" from wild forms of beet by transfer of a part of father's DNA to mother ovule with the help of vegetative vector, i.e. pollen tubes. Confirmation of the "transformation" phenomenon is the isozyme analysis carried out by us on which basis peculiar to father parent allele (NN-O) of marker gene Mdh-1 has been introduced in $M\gamma_1$ progeny, that is the reason to suppose introduction of alien (renewed) cytoplasm in gamma-induced progeny. The progeny with sterile plasma ($S\gamma$-cytoplasm) up to 47,4 % appears in one case, the normal fertile plasma ($N\gamma$- cytoplasm) up to 52,6 %appears in the other case

Usage of genetic potential of wild beet cytoplasms by means of gamma-induced transfer to cultivated species will allow not only to improve valuable agricultural traits but to protect sugar beet plants from pests and diseases too.

Thus, about 30 homozygous gamma-lines have been developed in the Department of Biotechnology, of which 20 are self-sterile with $S\gamma$-cytoplasm and 10 are self-fertile with $N\gamma$-cytoplasm. Using one of the lines, a hybrid on sterile basis is produced that if remarkable for high productivity, sugar content and sugar yield. Potential productivity is 65,6 t/ha, sugar content is 20,2 %, sugar yield is 12,07 t/ha. The hybrid is resistant to root rots and beet yellow virus (BYV)

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