

BIOFORTIFICATION OF TOMATO USING GENOME EDITING

IOVIENO P.*, CAPUANA M.*, SCARANO A.**, SANTINO A.**, BASSO M. F.***,
MARTINELLI F.***

*) Institute of Biosciences and Bioresources (IBBR) National Research Council of Italy (CNR), Via Madonna del Piano 10, 50019 Florence, Italy

**) Institute of Sciences of Food Production National Research Council of Italy (CNR), 73100 Lecce, Italy

***) Department of Biology, University of Florence, Via Madonna del Piano 6, 50019 Florence, Italy

biofortification, CRISPR/Cas9, genome editing, tomato

Almost one-third of the human population has dietary deficiencies of vitamins and minerals, influencing its health and impairing the quality of its life. Moreover, low- and middle-income countries' rural populations suffer from hidden hunger or micronutrient deficiency.

Biofortification is an intervention to improve the density of micronutrients using conventional breeding, agronomic, and biotechnology techniques in edible crops. Biofortification can help consumers that cannot afford varied diets, food supplements, or fortified processed foods. Conventional breeding allowed to obtain biofortified crops such as sweet potato for provitamin A, rice, and beans for zinc and iron respectively. Nowadays, there are some examples of biofortification obtained using transgenic methods such as high lysine maize, high unsaturated fatty acid soybean, high provitamin A, and iron-rich cassava. Golden rice, which contains a protein called beta-carotene, is one of the most famous examples.

The CRISPR (Clustered Regularly Interspaced Short Palindromic Repeats)/Cas9 (CRISPR-associated protein-9 nuclease) is based on an RNA guide and an engineered nuclease. This technology has been successful thanks to its simplicity, efficiency, and versatility. CRISPR/Cas9 lets to engineer new alleles of endogenous genes and improve plant quality and yield.

Our work aims to improve the nutritional or agronomic traits of *Solanum lycopersicum*

, one of the most consumed vegetables, using CRISPR/Cas9 technologies. Our goal is to obtain the biofortification of iodine, methionine, vitamin E, carotenoids, vitamin C, folic acid, active B9 vitamin, minerals, lysine, and selenium as well as to improve other agronomic traits such as epigenetic resilience, virus resistance and oxidative stress tolerance, biotic resistance, and seed yield in tomato. To reach it, we are using the CRISPR/Cas9 technique. Fifteen CRISPR/Cas9 vectors were obtained and used for the transformation of tomato plants by *Agrobacterium tumefaciens*. Four transgenic tomato lines were obtained and ten T0 tomato lines are going to be screened to identify the CRISPR/Cas9-induced mutations. Our work might support the fight against hunger, food insecurity, and human malnutrition by 2030.