

**Title:** The impact of genome editing on crop improvement

**Abstract:** Plant scientists are constantly striving to improve crop plants in ways that directly benefit consumers, farmers, and food processors. These efforts are guided by a need to address a set of fundamental problems, including a rapidly growing world population, a changing climate, an ongoing battle against pathogens and insects, worsening soils, the negative effects of agriculture on the environment, and the need for tastier and more nutritious foods. Researchers have used traditional plant breeding and transgenesis to address these issues, but both have significant disadvantages. Recently, genome editing has become reliable in plants, and this advance has the potential to dramatically speed research and crop improvement. Genome editing is a tool for making a specific genetic change at a targeted location in a genome. This technology, also called targeted mutagenesis, has been possible in bacteria, yeast, and mammalian systems for many years, but genome editing has only recently become efficient and widespread in plant research. The most wide-ranging breakthrough for genome editing in plant science came in 2013, when the highly versatile CRISPR/Cas9 genome-editing system was first applied to plants. This method involves the use of the Cas9 nuclease, which is targeted to a specific site in a genome by binding a guide RNA (gRNA). The gRNA has a specific 20 nt sequence within it that binds to complementary places in the genome. Once this binding occurs, Cas9 creates a double-stranded break at the binding site. While the normal DNA repair systems usually repair such breaks without fail, errors can occur, resulting in sequence insertions and deletions at the target site. Further modifications of the system allow for targeted insertions and deletions of various sizes, single base pair changes, allelic swaps, and even epigenetic changes. Here we will discuss the technology and how it can be used for plant improvement.