

## **CRISPR-CAS** Technology Used in Plants

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### ABSTRACT

The CRISPR/Cas9 system has been successfully applied in various plant species. The introduced mutations are inherited by the next generation of plants, indicating that plant genome editing can be used for plant research and the production of useful plants. Since the CRISPR-Cas system was successfully engineered to edit plant genomes in 2013, numerous efforts have been made to transform it into a more powerful tool. At present, CRISPR-Cas has multiplex editing capability, that is, it edits more than one gene at a time.

Keywords: CRISPR; DNA; Cas9 Enzyme; Genome editing

### HOW CRISPR USED IN PLANTS?

In plants, when CRISPR reagents are delivered into cells through Agrobacterium-mediated transformation, donor DNA fragments can be flanked by the target sequences so that even if the donors are integrated into the genome, they can be liberated by the nuclease. Horticultural crops, including fruit, vegetable, and ornamental plants are an important component of the agriculture production systems and play an important role in sustaining human life [1].

### WHAT ENZYME CRISPR USED IN PLANTS?

Conventional CRISPR complexes include an enzyme called Cas9, which recognizes and cuts a target stretch of DNA. To edit DNA sequences, the Cas9 enzyme must detect a short genetic sequence, called a protospacer-adjacent motif (PAM), and embedded in the target DNA [2].

# HOW CRISPR/CAS9 BEEN USED IN AGRICULTURE?

CRISPR can make plants more resistant to rain, wind, and storms, which would help increase yields at season end. Drought resistance - Similar to too much rain, not enough water causes many plants and livestock to be lost. Drought-resistant organisms would increase yields [3].

### HOW CRISPR/CAS9 USED IN HORTICULTURE?

Horticultural crops, including fruit, vegetable, and ornamental plants are an important component of the agriculture production systems and play an important role in sustaining human life. With a steady growth in the world's population and the consequent need for more food, sustainable and increased fruit and vegetable crop production is a major challenge to guarantee future food security. Although conventional breeding techniques have significantly contributed to the development of important varieties, new approaches are required to further improve horticultural crop production. Clustered regularly interspaced short palindromic repeats (CRISPR)/CRISPR-associated protein 9 (Cas9) has emerged as a valuable genome-editing tool able to change DNA sequences at precisely chosen loci [4].

### HOW CRISPR/CAS9 USED IN WOODY PLANTS?

Wood, the most abundant sustainable terrestrial plant biomass, is under increasing demand in the bio-based economy. In addition, there is a growing demand for chemical cellulose and other wood derived products. However, with less arable land available because of global warming and population growth; the ability to meet these demands is becoming difficult. While annual and other short rotation crops have been able to use traditional breeding techniques to make rapid advancements in trait improvement, advancements in industrially relevant traits in plantation forestry has been slow. Advancements in molecular breeding technologies will however mean that breeders will see faster gains. Recently, there has been promising results in using CRISPR gene editing technology in trees to increase the availability of novel genetic variants. In this project we take advantage of the CRISPR technology to create gene modifcations that will alter traits of industrial importance. Generated a suite of CRISPR constructs that target genes involved in the modification of xylan, one of the main biopolymers in plant secondary cell walls. Xylan has many interactions with lignin and cellulose polymers thereby contributing to recalcitrance of the cell wall. These interactions make the chemical processing and ultimate separation of these polymers diflcult.

### CONCLUSION

Due to increase of population and high demand of food worldwide,

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it is reported as a result of changes of climate and global warming there will be high increase of poverty and food shortage. So many technologies have emerged such as sequence specific nucleases (SSNs), transcriptional activators-like effector nucleases (TALENs) and Zinc Finger nucleases (ZFNs) to increase and improved yield. The emergence of CRISPR-Cas9 has shown greater promise in improving crop yield and preventing crop genetic diseases.

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