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A Short Review on Gene Editing Tool in Plant Science CRISPR-CAS9

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Abstract

Clustered regularly interspaced short palindromic repeat (CRISPR), a potent gene-editing tool, was found in 2012. CRISPR is a genetic engineering technique that enables genome editing in living creatures and is based on the bacterial CRISPR-Cas9 antiviral defense mechanism. It is simpler, less expensive, and more accurate than previous gene editing techniques. It also has a wide range of valuable uses, including improving crops and treating genetic diseases. This paper summarized the role of CRISPR-CAS9 tool in modern agricultural science.

Keywords : CRISPR, Agriculture, Gene editing, Modern tool, Plant modification

CRISPR-Cas9 role in plant Science

The goal of modern agricultural technology is to grow more crops on the same amount of land (Eş et al., 2019; Gao, 2018) The biggest issue in the modern world is climate change. Globally, the temperature is rising steadily as a result of climate change. The sector of agriculture is affected by this. Many forms of stress, including intense cold or heat, salinity, and waterlogging. In this setting, there is a greater need for food production due to the expanding population (Ricroch, 2019). It is now possible to alter the genomic sequence of different crops using this technique. As a result, the crops can withstand salinity, drought, or waterlogging. The crop can no longer be harmed by those pressures (Rao & Wang, 2021). In all crops, new varieties are being created utilizing the CRISPR-Cas9 system throughout time that are more sophisticated and productive than before. CRISPR-Cas9 technology has also been used on a growing number of monocot and dicot plant species to increase their productivity, quality, nutritional value, and tolerance to biotic and abiotic stresses (Angon & Habiba, 2023)[11]. The objective of this review is to know the role and future prospective of the CRISPR-Cas9 gene editing tool.

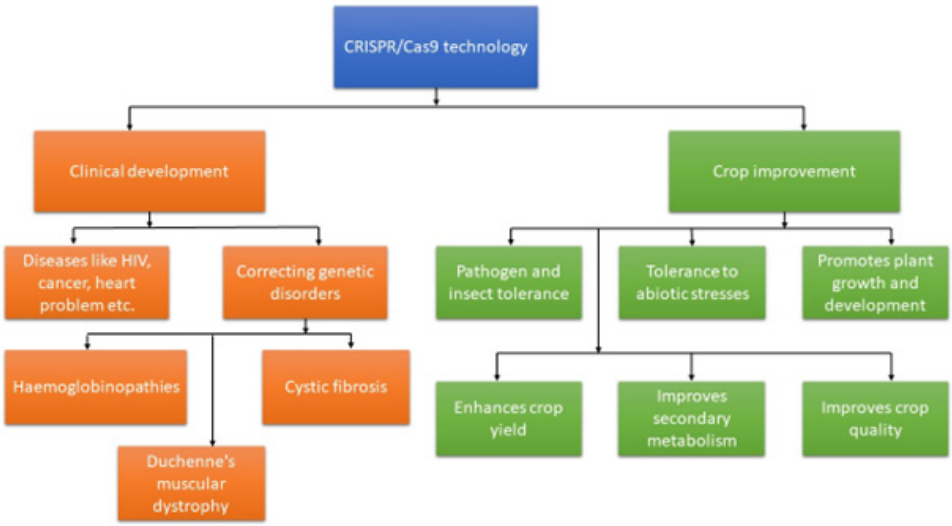

Figure: Role of CRISPR-Cas9

The CRISPR-Cas9 technique has been used on a variety of plants, including *Brassica oleracea, Hordeum vulgare, Cucumis sativus, Glycine max, Citrus sinensis, Nicotiana tabacum, Solanum lycopersicum, Oryza sativa, Solanum tuberosum, Triticum aestivum, Sorghum bicolor, Zea mays, Vitis vinifera etc* (Liu et al., 2021; Liu et al., 2017).

Pathogen, such as: *Magnaporthe oryzae and Xanthomonas oryzae pv. oryzae (Xoo)*, which cause serious damage to the rice plants (Le et al., 2022; Mehta et al., 2020). Tomato, citrus, orange, cucumber and cotton can defend against pathogens, *Pseudomonas syringae, Xanthomonas citri, Xanthomonas citri subsp. citri (Xcc)*, Cucumber vein yellowing virus, *Verticillium dahliae*, respectively. CRISPR-Cas9 technique knocked out the targeted genes by the agrobacterium transformation method (Le et al., 2022; Bhowmik et al., 2021; Zhang et al., 2021).

CRISPR-Cas9 method edited or knocked out the targeted gene for making crops resistant to abiotic stress. *The AGROS8* gene for maize and the *PPa6* gene for rice are the most popular examples.

In rice, *gw2, gw5,* and *tgw6*, negative regulators of grain weight, were knocked out using CRISPR-Cas9 technology; mutants produced as a result of genome editing have increased grain size and weight. CRISPR-Cas9-edited mutants of *GASR7* increased the grain weight of wheat. CRISPR-Cas edited cis-regulatory element CLV-WUS was used to increase tomato fruit size (Zhang et al., 2021).

Conclusion

Although there are several potential uses for CRISPR/Cas9 technology in crop breeding, there are still certain restrictions. Since these features are necessary for employing this instrument, a significant obstacle is the small number of genes affecting crucial agronomic parameters. In this context, there is a pressing need to understand genomic sequence data and investigate premium genetic resources for agricultural enhancement. From this, it is understood that the role of CRISPR-Cas9 in crop development is immense. In the future, the use of CRISPR-Cas9 technology in the agriculture sector will be widespread, and it is now the demand of time.

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