JUST AGRICULTURE
multidisciplinary e-Newsletter

A New Technology:- CRISPR-Cas 9 Technology

Divya Singh[*], Abhay Kumar Pandey[1], Akanksha Singh[1] and Piyusha Singh[2]

[1]Department of Genetics and Plant Breeding, Acharya Narendra Dev University of Agriculture and Technology,Kumarganj, Ayodhya, Uttar Pradesh,(224229), India.
[2]Assistant Professor, Department of Genetics and Plant Breeding, Acharya Narendra Dev University of Agriculture and Technology, Kumarganj, Ayodhya, Uttar Pradesh,(224229)

ARTICLE ID: 01

Abstract

The advancement of new genetic techniques (NGT) has increased the profound development in crop improvement. The (NGT) has broadened the agricultural research area, bringing new opportunities to develop novel plant varieties. One of the most widely used techniques is CRISPR- Cas 9 which is (clustered regularly interspaced short palindromic repeat).With the advancement of these technologies,a scientist can targetgenes of interest.Unlike first-technology genome-modifying gear, CRISPR/Cas9 genome editing includes simple designing and cloning methods, with the identical Cas9 being the potential to be had for use with one-of-a-kind guide RNAs concentrated on a couple of websites within the genome.

Keywords – genetic, interest, genome editing, CRISPR-Cas9.

Introduction

The CRISPR, (first coined in 2002; Jansen *et al*., 2002) refers to tandem repeats flanked by non- repetitive DNA stretches that were first observed in the downstream of Escherichia coli IAP genes. CRISPR genome enhancement entails designing a guide RNA (gRNA) of approximately 20 nucleotides complementary to the DNA stretch inside the goal gene. CRISPR targets endogenous gene that is difficult to specifically target using RNAi technology with more precision and simplicity.

Procedure

The CRISPR cleavage methodology requires: -

- a brief artificial gRNA sequence of 20 nucleotides that bind to the goal DNA and
- Cas9 nuclease enzyme that cleaves three–four bases after the protospacer adjoining motif (PAM; commonly, 50 NGG).

JUST AGRICULTURE
multidisciplinary e-Newsletter

CRISPR Cas9 involves easy steps viz.

a. Figuring out the PAM sequence within the goal gene,
b. Synthesizing a single RNA (sgRNA)
c. Cloning the sgRNA right into a suitable binary vector,
d. Introduction into host species/cell line strains formation accompanied with the aid of
e. Screening and
f. Validation of edited lines

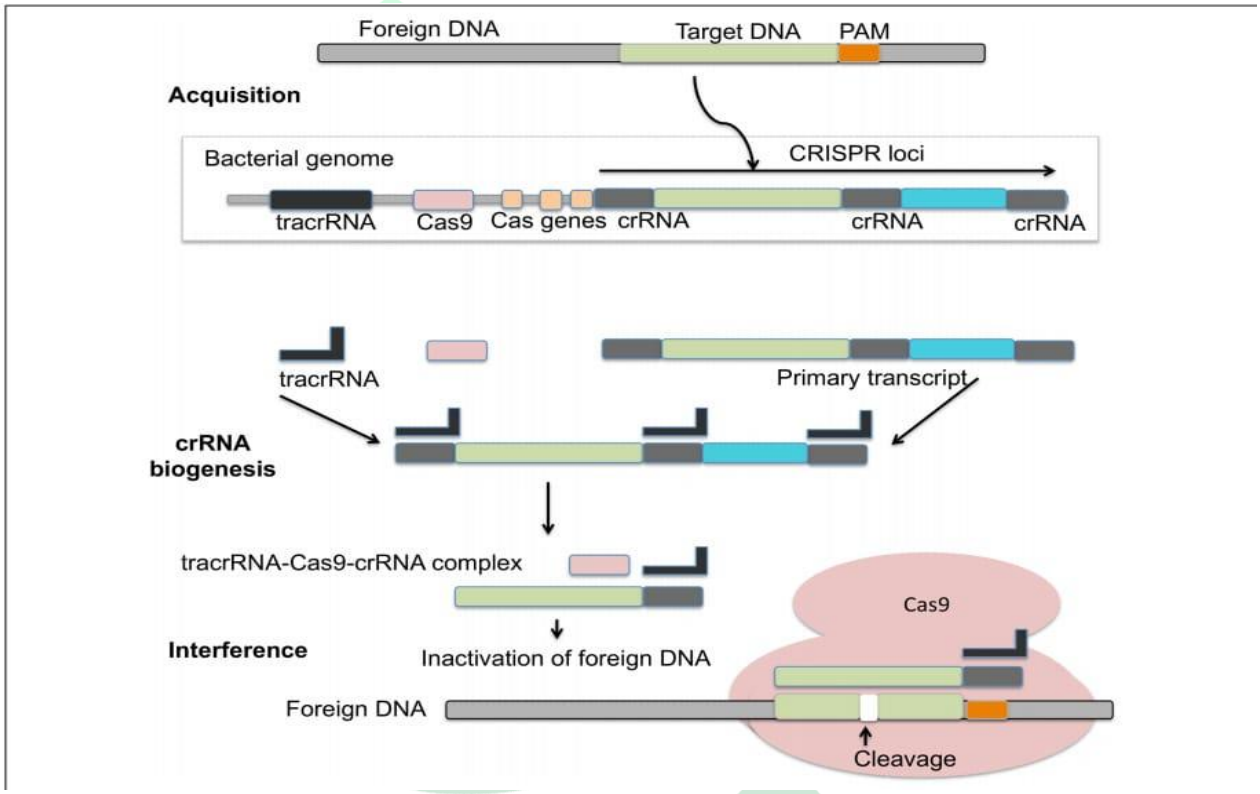

Figure 1: - Mechanism of CRISPR/ Cas 9 gene action explained by Arora, L., and Narula, A., (2017).

Application

The CRISPR/Cas-primarily based editing gear was used to grow plant resistance to fungal illnesses. In barley Crop.MLO gene is developed to resistance to powdery mildew by the knock out method.(Borrelli, *et al*., 2018). In Rice crops, OsERF922 is involved in the modulation of multiple stress tolerance by knock out method to enhance blast resistance.(Wang, *et al.*, 2016).

Increasing yield is the main objective of research aimed at enhancing vegetation. Specific grain yield-associated tendencies consist of grain quantity and size per panicle, tiller

JUST AGRICULTURE
multidisciplinary e-Newsletter

variety per panicle, grain weight, and grain size.(Miao *et al.*, 2018) generated a pyl1/4/6 triple knockout rice mutant using the CRISPR/Cas9 system, the mutant has a higher yield compared to the wild type.

Conclusion

New breeding techniques offer scientists the capacity to exactly and speedy insert the favored tendencies than traditional breeding. CRISPR/Cas9-based genome modifying is an essential leap forward method. It is one of the best technology for genome editing tools which help to create multiple attributes like tolerance to abiotic and biotic stress in plants. The prevalent use of this technology will surely expedite its pace.

Reference

Arora, L., &Narula, A. (2017). Gene editing and crop improvement using CRISPR-Cas9 system. *Frontiers in plant science*, *8*, 1932.

Butler, N. M., Jiang, J., &Stupar, R. M. (2018). Crop improvement using genome editing. *Plant breeding reviews*, *41*, 55-101.

Hüdig, M., Laibach, N., & Hein, A. C. (2022). Genome Editing in Crop Plant Research—Alignment of Expectations and Current Developments. *Plants*, *11*(2), 212.

Jansen, R., Embden, J. D., Gaastra, W., and Schouls, L. M. (2002). Identification of genes that are associated with DNA repeats in prokaryotes. Mol. Microbiol. 43, 1565–1575. doi: 10.1046/j.1365-2958.2002.02839.x