APPLICATIONS OF CRISPR-CAS9 IN AGRICULTURE

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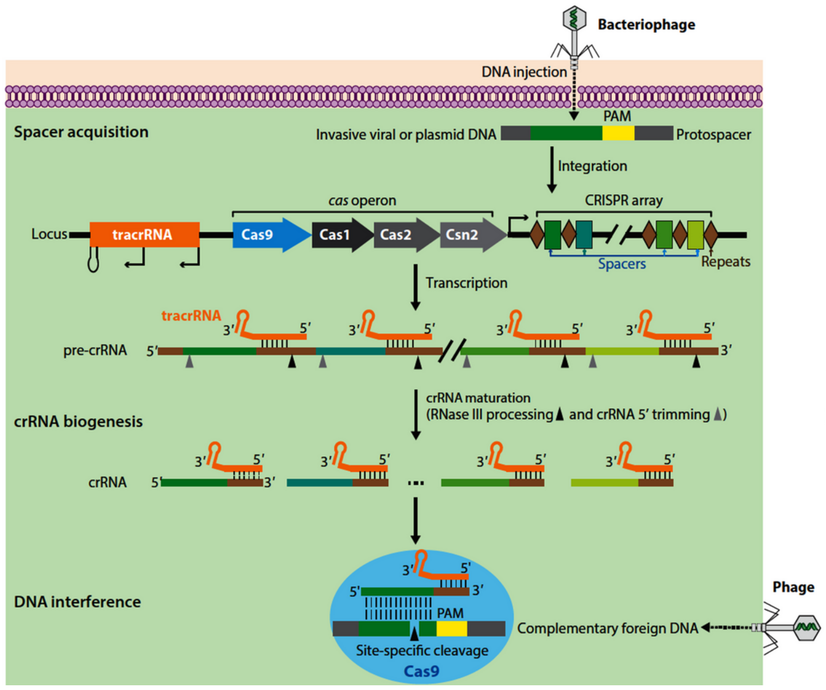
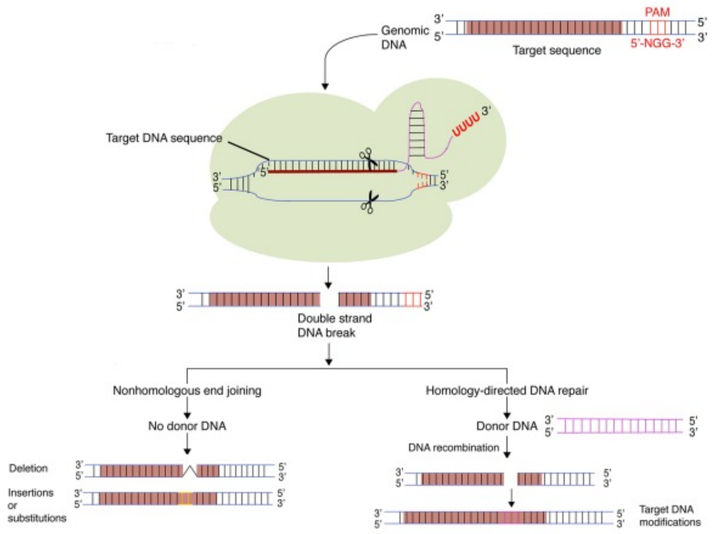
OBJECTIVES

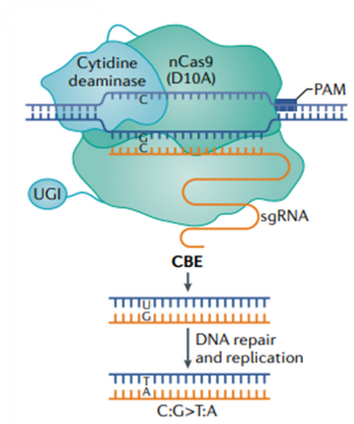
1. Bibliographic revision of CRISPR-Cas literature.
2. Agricultural applications and product enhancement.
3. Examples of modifications.



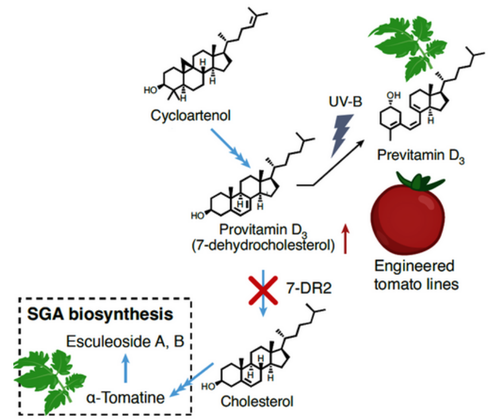
CRISPR-Cas is a self defense system of bacterial cells that works by cutting the viral DNA when it enters the cell, because the cr-ARN-Cas9 complex can recognize the viral DNA [1].



When the sgRNA and Cas9 enter the cell, they scan the genome until sgARN finds a place where it can hybridize with DNA. Then, Cas9 cuts both DNA strands and induces the DBS [2].



It allows the transition from C:G to T:A using the nCas9 and two other proteins: cytidine deaminase and uracil DNA glycosylase [3].



When the Sl7-DR2 gene is silenced, nearly all 7-DHC can be accumulated becoming vitamin D3 when exposed to UV radiation [4].

Plant	Gene	Objective	Reference
Rice	OsNRAMP5	Cadmium reduction in rice grain	Yang et al. 2019
Rice	OsLCT1	Cadmium reduction in rice grain	Chen et al. 2023
Rice	OsNRAMP5 and OsLCT1	Cadmium reduction in rice grain	Chen et al. 2023
Wheat	**35 different genes**	Gluten reduction	Sánchez-León et al. 2018
Tomato	Sl7-DR2	Tomato enhancement with vitamin D	Li et al. 2022
Potato (S. tuberosum)	StSSR2	α-solanine and α-chaconine reduction	Zheng et al. 2021

CONCLUSION

- **CRISPR-Cas9 is a technique of genetic modification whereby genes can be silenced and/or edited. Thus, we can give desirable traits to plants, enhance the nutritional value of products and reduce the effects of climate change in agriculture.**
- **There is only one product in the market that has been modified using CRISRP, a GABA enriched tomato.**

BIBLIOGRAPHY

[1] Jiang F, Doudna JA. CRISPR–Cas9 Structures and Mechanisms. Annual Review of Biophysics. 2017;46(1):505–529. doi:10.1146/annurev-biophys-062215-010822
[2] El-Mounadi K, Morales-Floriano ML, Garcia-Ruiz H. Principles, Applications, and Biosafety of Plant Genome Editing Using CRISPR-Cas9. Frontiers in Plant Science. 2020;11:56. doi:10.3389/fpls.2020.00056
[3] Zhu H, Li C, Gao C. Applications of CRISPR–Cas in agriculture and plant biotechnology. Nature Reviews Molecular Cell Biology. 2020;21(11):661–677. doi:10.1038/s41580-020-00288-9
[4] Van Der Straeten D, Strobbe S. Tomatoes supply the 'sunshine vitamin.' Nature Plants. 2022;8(6):604–606. doi:10.1038/s41477-022-01158-2