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Long-distance genome editing in grafted plants using tRNA like sequence and CRISPR/Cas9 system

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At present, CRISPR/Cas9 genome editing system has been widely used in plant breeding, but this genetic transformation-based genome editing technology is expensive and laborious, making it not applicable to most important crops. Published in *Nature Biotechnology*, Yang et al. innovatively fused tRNA like sequence (TLS) and CRISPR/Cas9 genome editing system and combined grafting with the 'mobile' CRISPR/Cas9 genome editing tool to enable long-distance gene editing across species in plant.

The first innovation of this study is the combination of TLS and CRISPR/Cas9 genome editing system. The fusion of this mobile TLS element into CRISPR/Cas9 sequence, so that transgenic plants can produce 'mobile' CRISPR/Cas9 RNA. Then, wild type *Arabidopsis* scion was grafted onto transgenic *Arabidopsis* rootstock producing mobile CRISPR/Cas9 RNA, and it was detected that mobile CRISPR/Cas9 RNA moved from the rootstock to various tissues in the scion, and finally produced mutated seeds, which achieved heritable transgenic-free genome editing in plants. The second innovation of this study is to successfully apply this graft-mobile editing system to the cross-species grafting of *Arabidopsis* and *Brassica rapa*. The researchers successfully transferred the Cas9 and gRNA transcripts produced in the transgenic rootstock to the wild type *Brassica rapa* scion by using the easily transformed *Arabidopsis* as the rootstock to graft with the wild type *Brassica rapa*, and completed the editing of the target gene, enabling long- distance genome editing of plants across species. The graft-mobile editing systems for transgene-free plant production set up a fast and efficient method for future molecular precision design breeding. Moreover, it provides a feasible new genome editing approach for perennial horticultural crops with long juvenile phase. For instance, citrus has a juvenile phase of up to 8–10 years, and the genetic transformation efficiency is extremely low. If this technology is used, genome editing can be completed in citrus scion by grafting on transgenic rootstock (Fig. 1). It is expected that the fruit phenotype can be seen in 2–3 years, and the problem of difficult genetic transformation can be solved, which can greatly improve the efficiency of research and breeding.

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Fig. 1 Citrus shoot grafting. Credit: Veer Photo.

Conflict of interest

The author declares that there is no conflict of interest.

Dates

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