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INSPIRED CELL SOLUTIONS

CRISPR-Cas9 gene editing in plants

The following are a list of publications that demonstrate the application of CRISPR-Cas9 genome editing techniques for targeted gene knockout or precise knockin in a variety of plant species.

1. Svitashev, S., C. Schwartz, *et al.* Genome editing in maize directed by CRISPR–Cas9 ribonucleoprotein complexes. *Nat. Commun.* **7**, (2016). [*Zea mays* – particle bombardment of embryos]
2. Svitashev, S., J. Young, *et al.* Targeted Mutagenesis, Precise Gene Editing, and Site-Specific Gene Insertion in Maize Using Cas9 and Guide RNA. *Plant Physiol.* **2**, 931-945 (2015). [*Zea mays* – particle bombardment of embryos]
3. Woo, J.W., J. Kim, *et al*. DNA-free genome editing in plants with preassembled CRISPR-Cas9 ribonucleoproteins. *Nat. Biotechnol.* **33**, 1162-1164 (2015). [*Arabidopsis*, *Oryza sativa*, and *Lactuca sativa* – protoplast transfection]
4. Subburaj, S., S. J. Chung, *et al.* Site-directed mutagenesis in *Petunia* × *hybrida* protoplast system using direct delivery of purified recombinant Cas9 ribonucleoproteins. *Plant Cell Rep.* **7**, 1535-1544 (2016). [*Petunia* × *hybrida* – protoplast transfection]
5. Zhang, Y., Z. Liang, *et al.* Efficient and transgene-free genome editing in wheat through transient expression of CRISPR/Cas9 DNA or RNA. *Nat. Commun.* **7**, (2016). [*Triticum aestivum* – particle bombardment of protoplasts]
6. Malnoy, M., R. Viola, *et al*. DNA-Free Genetically Edited Grapevine and Apple Protoplast Using CRISPR/Cas9 Ribonucleoproteins. *Front. Plant Sci.* **7**, (2016). [*Chardonnay* and *Golden Delicious* – protoplast transformation]
7. Baek, K. D. H. Kim, *et al*. DNA-free two-gene knockout in *Chlamydomonas reinhardtii* via CRISPR-Cas9 ribonucleoproteins. *Sci. Rep.* **6**, (2016). [*Chlamydomonas reinhardtii* – transformation]
8. Li, J.F., J.E. Norville, *et al.* Multiplex and homologous recombination-mediated genome editing in *Arabidopsis* and *Nicotiana benthamiana* using guide RNA and Cas9. *Nat. Biotechnol.* **31**, 688-691 (2013). [*Arabidopsis thaliana* and *Nicotiana benthamiana* - PEG-protoplast transfection, leaf agroinfiltration]
9. Jiang, W., H. Zhou, *et al*. Demonstration of CRISPR/Cas9/sgRNA-mediated targeted gene modification in *Arabidopsis,* tobacco, sorghum and rice. *Nucleic Acids Res.* **41**, e188 (2013). [*Arabidopsis thaliana*, *Nicotiana benthamiana*, *Oryza sativa* and *Sorghum bicolor* - leaf agroinfiltration, PEG-protoplast transfection]
10. Mao, Y., H. Zhang, *et al*. Application of the CRISPR-Cas System for Efficient Genome Engineering in *Plants*. *Mol. Plant.* **6**, 2008-2011 (2013). [*Arabidopsis thaliana* and *Oryza sativa* - agro-transformation by floral dip, stable agro-transformation]
11. Fauser, F., S. Schiml, *et al*. Both CRISPR/Cas-based nucleases and nickases can be used efficiently for genome engineering in *Arabidopsis thaliana*. *Plant J.* **79**, 348-359 (2014). [*Arabidopsis thaliana* - agro-transformation by floral dip, stable agro-transformation]
12. Peterson, B.A., D.C. Haak, *et al*. Genome-Wide Assessment of Efficiency and Specificity in CRISPR/Cas9 Mediated Multiple Site Targeting in *Arabidopsis*. *PLoS One*. **11**, e0162169 (2016). [*Arabidopsis thaliana* – agro-transformation by floral dip]
13. Pyott, D.E., E. Sheehan, *et al*. Engineering of CRISPR/Cas9-mediated potyvirus resistance in transgene-free *Arabidopsis* plants. *Mol. Plant Pathol.* **17**, 1276-1288 (2016). [*Arabidopsis thaliana* – agro-transformation by floral dip]
14. Nekrasov, V., B. Staskawicz, *et al*. Targeted mutagenesis in the model plant *Nicotiana benthamiana* using Cas9 RNA-guided endonuclease. *Nat. Biotechnol.* **31**, 691-693 (2013). [*Nicotiana benthamiana* - leaf agroinfiltration]
15. Upadhyay, S.K., J. Kumar, *et al*. RNA-Guided Genome Editing for Target Gene Mutations in Wheat. G3 (*Bethesda*) **3**, 2233-2238 (2013). [*Nicotiana benthamiana* and *Triticum aestivum* - leaf agroinfiltration]
16. Shan, Q., Y. Wang, *et al*. Targeted genome modification of crop plants using a CRISPR-Cas system. *Nat. Biotechnol.* **31**, 686-688 (2013). [*Oryza sativa* and *Triticum aestivum* - PEG-protoplast transfection, particle bombardment of callus]
17. Xie, K. and Y. Yang. RNA-guided genome editing in plants using a CRISPR-Cas system. *Mol. Plant.* **6**, 1975-1983 (2013). [*Oryza sativa* – PEG-protoplast transfection]
18. Zhou, H. and B. Liu. Large chromosomal deletions and heritable small genetic changes induced by CRISPR/Cas9 in rice. *Nucleic Acids Res.* **42**, 10903-10914 (2014). [*Oryza sativa* – PEG-protoplast transfection]
19. Miao, J., D. Guo, *et al*. Targeted mutagenesis in rice using CRISPR-Cas system. *Cell Res.* **23**, 1233-1236 (2013). [*Oryza sativa* – agro-transformation of callus, transient particle bombardment of callus]

20. Baysal, C., L. Bortesi, *et al*. CRISPR/Cas9 activity in the rice *OsBEIIb* gene does not induce off-target effects in the closely related paralog *OsBEIIa*. *Mol. Breeding*. **36**, (2016). [*Oryza sativa* - particle bombardment of embryos]
21. Brooks, C., V. Nekrasov, *et al*. Efficient Gene Editing in Tomato in the First Generation Using the Clustered Regularly Interspaced Short Palindromic Repeats/CRISPR-Associated9 System. *Plant Physiol*. **166**, 1292-1297 (2014). [*Solanum lycopersicum* - agro-transformation of cotyledons]
22. Ron, M., K. Kajala, *et al*. Hairy root transformation using *Agrobacterium rhizogenes* as a tool for exploring cell type-specific gene expression and function using tomato as a model. *Plant Physiol*. **166**, 455-469 (2014). [*Solanum lycopersicum* - hairy root transformation by *A. rhizogenes*]
23. Pan, C., L. Ye, *et al*. CRISPR/Cas9-mediated efficient and heritable targeted mutagenesis in tomato plants in the first and later generations. *Sci. Rep*. **6** (2016). [*Solanum lycopersicum* - agro-transformation of leaf discs]
24. Jia, H. and N. Wang. Targeted genome editing of sweet orange using Cas9/sgRNA. *PLoS One*. **9**, e93806 (2014). [*Citrus sinensis* - leaf agroinfiltration]
25. Sugano, S.S., M. Shirakawa, *et al*. CRISPR/Cas9-mediated targeted mutagenesis in the liverwort *Marchantia polymorpha L. Plant Cell Physiol*. **55**, 475-481 (2014). [*Marchantia polymorpha* - agro-transformation of sporelings]
26. Liang, Z., K. Zhang, *et al*. Targeted mutagenesis in *Zea mays* using TALENs and the CRISPR/Cas system. *J. Genet. Genomics*. **41**, 63-68 (2014). [*Zea mays* – PEG-protoplast transfection]
27. Shi, J., H. Gao, *et al*. ARGOS8 variants generated by CRISPR-Cas9 improve maize grain yield under field drought stress conditions. *Plant Biotechnol. J.* (2016). [*Zea mays* – particle bombardment of embryos]
28. Nishitani, C., N. Hirai, *et al*. Efficient Genome Editing in Apple Using a CRISPR/Cas9 system. *Sci. Rep*. **6**, (2016). [*Malus prunifolia* – agro-transformation of shoots]
29. Fan, D., T. Liu, *et al*. Efficient CRISPR/Cas9-mediated Targeted Mutagenesis in *Populus* in the First Generation. *Sci. Rep*. **5**, (2015). [*Populus tomentosa* – agro-transformation of leaf discs]
30. Lawrenson, T., O. Shorinola, *et al*. Induction of targeted, heritable mutations in barley and *Brassica oleracea* using RNA-guided Cas9 nuclease. *Genome Biol*. **16**, (2015). [*Hordeum vulgare* and *Brassica oleracea* – agro-transformation of embryos, agro-transformation of cotyledonary petioles]

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