

Year	Applied plant species
ID	Affiliation, country
Identifiers	Title
Category	Description
	Details
2014 18 PMID:24643227 TALEN	barley Leibniz Institute of Plant Genetics and Crop Plant Research (IPK), Gatersleben, Germany True-breeding targeted gene knock-out in barley using designer TALE-nuclease in haploid cells. Gurushidze M, Hensel G, Hiekel S, Schedel S, Valkov V, Kumlehn J. PLoS One. 2014;9(3):e92046. doi: 10.1371/journal.pone.0092046.
2013 19 PMID:24576457 TALEN/CRISPR	corn Chinese Academy of Sciences (CAS), Beijing, China Targeted mutagenesis in <i>Zea mays</i> using TALENs and the CRISPR/Cas system. Liang Z, Zhang K, Chen K, Gao C. J Genet Genomics. 2014 Feb 20;41(2):63-8. doi: 10.1016/j.jgg.2013.12.001. Epub 2013 Dec 14.
2014 20 PMID:24556552 TALEN	rice Chinese Academy of Sciences (CAS), Beijing, China An efficient TALEN mutagenesis system in rice. Chen K, Shan Q, Gao C. Methods. 2014 Aug 15;69(1):2-8. doi: 10.1016/j.ymeth.2014.02.013. Epub 2014 Feb 17.
2014 21 PMID:24521457 TALEN	Nicotiana benthamiana, rice Chinese Academy of Agricultural Sciences (CAAS), Beijing, China The last half-repeat of transcription activator-like effector (TALE) is dispensable and thereby TALE-based technology can be simplified. Zheng CK, Wang CL, Zhang XP, Wang FJ, Qin TF, Zhao KJ. Mol Plant Pathol. 2014 Sep;15(7):690-7. doi: 10.1111/mpp.12125. Epub 2014 Apr 10.
2013 22 PMID:23979944 TALEN	Arabidopsis University of Minnesota, MN, USA Targeted mutagenesis of Arabidopsis thaliana using engineered TAL effector nucleases. Christian M, Qi Y, Zhang Y, Voytas DF. G3 (Bethesda). 2013 Oct 3;3(10):1697-705. doi: 10.1534/g3.113.007104.
2013 23 PMID:23870552 TALEN	Brassica oleracea Southwest University, Chongqing, China Site-specific gene targeting using transcription activator-like effector (TALE)-based nuclease in Brassica oleracea. Sun Z, Li N, Huang G, Xu J, Pan Y, Wang Z, Tang Q, Song M, Wang X. J Integr Plant Biol. 2013 Nov;55(11):1092-103. doi: 10.1111/jipb.12091. Epub 2013 Sep 18.
2013 24 PMID:23689819 TALEN	barley Aarhus University, Slagelse, Denmark TAL effector nucleases induce mutations at a pre-selected location in the genome of primary barley transformants. Wendt T, Holm PB, Starker CG, Christian M, Voytas DF, Brinch-Pedersen H, Holme IB. Plant Mol Biol. 2013 Oct;83(3):279-85. doi: 10.1007/s11103-013-0078-4. Epub 2013 May 21.
2013 25 PMID:23625357 TALEN/ZFN	Nicotiana benthamiana, Arabidopsis Weizmann Institute of Science, Rehovot, Israel A rapid assay to quantify the cleavage efficiency of custom-designed nucleases in planta. Johnson RA, Gurevich V, Levy AA. Plant Mol Biol. 2013 Jun;82(3):207-21. doi: 10.1007/s11103-013-0052-1. Epub 2013 Apr 28.
2013 26 PMID:23430045 TALEN	rice Iowa State University, Ames, USA Designer TAL effectors induce disease susceptibility and resistance to Xanthomonas oryzae pv. oryzae in rice. Li T, Huang S, Zhou J, Yang B. Mol Plant. 2013 May;6(3):781-9. doi: 10.1093/mp/sst034. Epub 2013 Feb 21.

表2. NBT応用植物に関する文献調査結果(TALEN) (その4)

Year	Applied plant species
ID	Affiliation, country
Identifiers	Title
Category	Description
	Details
2013 27 PMID:23288864 TALEN	rice, Brachypodium Chinese Academy of Sciences (CAS), Beijing, China Rapid and efficient gene modification in rice and Brachypodium using TALENs. Shan Q, Wang Y, Chen K, Liang Z, Li J, Zhang Y, Zhang K, Liu J, Voytas DF, Zheng X, Zhang Y, Gao C. Mol Plant. 2013 Jul;6(4):1365-8. doi: 10.1093/mp/sss162. Epub 2013 Jan 2. No abstract available.
2013 28 PMID:23124327 TALEN	tobacco University of Electronic Science and Technology of China, Chendu, China Transcription activator-like effector nucleases enable efficient plant genome engineering. Zhang Y, Zhang F, Li X, Baller JA, Qi Y, Starker CG, Bogdanove AJ, Voytas DF. Plant Physiol. 2013 Jan;161(1):20-7. doi: 10.1104/pp.112.205179. Epub 2012 Nov 2.
2012 29 PMID:23078195 TALEN	rice Colorado State University, CO, USA Transcription activator-like (TAL) effectors targeting OsSWEET genes enhance virulence on diverse rice (<i>Oryza sativa</i>) varieties when expressed individually in a TAL effector-deficient strain of <i>Xanthomonas oryzae</i> . Verdier V, Triplett LR, Hummel AW, Corral R, Cernadas RA, Schmidt CL, Bogdanove AJ, Leach JE. New Phytol. 2012 Dec;196(4):1197-207. doi: 10.1111/j.1469-8137.2012.04367.x. Epub 2012 Oct 18.
2012 30 PMID:22565958 TALEN	rice Iowa State University, IA, USA High-efficiency TALEN-based gene editing produces disease-resistant rice. Li T, Liu B, Spalding MH, Weeks DP, Yang B. Nat Biotechnol. 2012 May 7;30(5):390-2. doi: 10.1038/nbt.2199. No abstract available.
2012 31 PMID:22271303 TALEN	tobacco King Abdullah University of Science and Technology, Thuwal, Saudi Arabia Rapid and highly efficient construction of TALE-based transcriptional regulators and nucleases for genome modification. Li L, Piatek MJ, Atef A, Piatek A, Wibowo A, Fang X, Sabir JS, Zhu JK, Mahfouz MM. Plant Mol Biol. 2012 Mar;78(4-5):407-16. doi: 10.1007/s11103-012-9875-4. Epub 2012 Jan 22.
2011 32 PMID:21493687 TALEN	Arabidopsis University of Minnesota, MN, USA Efficient design and assembly of custom TALEN and other TAL effector-based constructs for DNA targeting. Cermak T, Doyle EL, Christian M, Wang L, Zhang Y, Schmidt C, Baller JA, Somia NV, Bogdanove AJ, Voytas DF. Nucleic Acids Res. 2011 Jul;39(12):e82. doi: 10.1093/nar/gkr218. Epub 2011 Apr 14. Erratum in: Nucleic Acids Res. 2011 Sep 1;39(17):7879.
2011 33 PMID:21262818 TALEN	tobacco King Abdullah University of Science and Technology, Thuwal, Saudi Arabia De novo-engineered transcription activator-like effector (TALE) hybrid nuclease with novel DNA binding specificity creates double-strand breaks. Mahfouz MM, Li L, Shamimuzzaman M, Wibowo A, Fang X, Zhu JK. Proc Natl Acad Sci U S A. 2011 Feb 8;108(6):2623-8. doi: 10.1073/pnas.1019533108. Epub 2011 Jan 24.

表3. NBT応用植物に関する文献調査結果(CRISPR) (その1)

query: CRISPR, cas9, plant, arabidopsis, nicotiana (as of 2016/2/19)

Year	Applied plant species
ID	Affiliation, country
Identifiers	Title
Category	Description
	Details
2016 1 PMID:26870061 CRISPR	Nicotiana tabacum Université Catholique de Louvain Louvain-la-Neuve, Belgium Gene Inactivation by CRISPR-Cas9 in Nicotiana tabacum BY-2 Suspension Cells. Merx S, Tollet J, Magy B, Navarre C, Boutry M. Front Plant Sci. 2016;7:40. doi: 10.3389/fpls.2016.00040.
2016 2 PMID:26864017 TALEN/CRISPR	Arabidopsis, Linum usitatissimum Cibus, CA, USA Oligonucleotide-mediated genome editing provides precision and function to engineered nucleases and antibiotics in plants. Sauer NJ, Narváez-Vásquez J, Mozoruk J, Miller RB, Warburg ZJ, Woodward MJ, Mihiret YA, Lincoln TA, Segami RE, Sanders SL, Walker KA, Beetham PR, Schöpke CR, Gocal GF Plant Physiol. 2016 Feb 10. doi:pii: pp.01696.2015. [Epub ahead of print]
2015 3 PMID:26842992 CRISPR	corn Chinese Academy of Sciences, Beijing, China Efficient Targeted Genome Modification in Maize Using CRISPR/Cas9 System. Feng C, Yuan J, Wang R, Liu Y, Birchler JA, Han F. J Genet Genomics. 2016 Jan 20;43(1):37-43. doi: 10.1016/j.jgg.2015.10.002. Epub 2015 Oct 30.
2015 4 PMID:26842991 CRISPR	corn China Agricultural University, Beijing, China Efficiency and Inheritance of Targeted Mutagenesis in Maize Using CRISPR-Cas9. Zhu J, Song N, Sun S, Yang W, Zhao H, Song W, Lai J. J Genet Genomics. 2016 Jan 20;43(1):25-36. doi: 10.1016/j.jgg.2015.10.006. Epub 2015 Dec 21.
2016 5 PMID:26839579 CRISPR	Nicotiana benthamiana Universidad Politécnica de Valencia, Spain A modular toolbox for gRNA-Cas9 genome engineering in plants based on the GoldenBraid standard. Vazquez-Vilar M, Bernabé-Orts JM, Fernandez-Del-Carmen A, Ziarsolo P, Blanca J, Granell A, Orzaez D. Plant Methods. 2016;12:10. doi: 10.1186/s13007-016-0101-2.
2016 6 PMID:26837606 CRISPR	Petunia Southwest University, Chongqing, China Exploiting the CRISPR/Cas9 System for Targeted Genome Mutagenesis in Petunia. Zhang B, Yang X, Yang C, Li M, Guo Y. Sci Rep. 2016 Feb 3;6:20315. doi: 10.1038/srep20315.
2016 7 PMID:26825596 CRISPR	Petunia Chungnam National University, Daejeon, South Korea Site-directed mutagenesis in Petunia x hybrida protoplast system using direct delivery of purified recombinant Cas9 ribonucleoproteins. Subburaj S, Chung SJ, Lee C, Ryu SM, Kim DH, Kim JS, Bae S, Lee GJ. Plant Cell Rep. 2016 Jan 29. [Epub ahead of print]
2016 8 PMID:26808139 CRISPR	cucumber ARO, Volcani Center, Bet-Dagan, Israel Development of broad virus resistance in non-transgenic cucumber using CRISPR/Cas9 technology. Chandrasekaran J, Brumin M, Wolf D, Leibman D, Klap C, Pearlsman M, Sherman A, Arazi T, Gal-On A. Mol Plant Pathol. 2016 Jan 25. doi: 10.1111/mpp.12375. [Epub ahead of print]

表3. NBT応用植物に関する文献調査結果(CRISPR) (その2)

Year	Applied plant species
ID	Affiliation, country
Identifiers	Title
Category	Description
	Details
2016 9	rice Chinese Academy of Agricultural Sciences (CAAS), Beijing, China
PMID:26768120	Engineering Herbicide Resistant Rice Plants through CRISPR/Cas9-mediated Homologous Recombination of the Acetolactate Synthase.
CRISPR	Sun Y, Zhang X, Wu C, He Y, Ma Y, Hou H, Guo X, Du W, Zhao Y, Xia L. Mol Plant. 2016 Jan 5. doi:pii: S1674-2052(16)00002-2. 10.1016/j.molp.2016.01.001. [Epub ahead of print]
2015 10	rice Chinese Academy of Agricultural Sciences, Hangzhou, China
PMID:26743988	A Simple CRISPR/Cas9 System for Multiplex Genome Editing in Rice.
CRISPR	Wang C, Shen L, Fu Y, Yan C, Wang K. J Genet Genomics. 2015 Dec 20;42(12):703-6. doi: 10.1016/j.jgg.2015.09.011. Epub 2015 Oct 24.
2015 11	rice National Institute of Agrobiological Sciences, Japan
PMID:26668334	Biallelic Gene Targeting in Rice.
CRISPR	Endo M, Mikami M, Toki S. Plant Physiol. 2016 Feb;170(2):667-77. doi: 10.1104/pp.15.01663. Epub 2015 Dec 14.
2015 12	Arabidopsis Chinese Academy of Sciences, Shanghai, China
PMID:26661595	A multiplex CRISPR/Cas9 platform for fast and efficient editing of multiple genes in Arabidopsis.
CRISPR	Zhang Z, Mao Y, Ha S, Liu W, Botella JR, Zhu JK. Plant Cell Rep. 2015 Dec 10. [Epub ahead of print]
2015 13	rice The University of Tokyo, Japan
PMID:26617267	Generation of artificial drooping leaf mutants by CRISPR-Cas9 technology in rice.
CRISPR	Ikeda T, Tanaka W, Mikami M, Endo M, Hirano HY. Genes Genet Syst. 2016 Jan 6;90(4):231-5. doi: 10.1266/ggs.15-00030. Epub 2015 Nov 30.
2015 14	barley, Brassica oleracea John Innes Centre, UK
PMID:26616834	Induction of targeted, heritable mutations in barley and Brassica oleracea using RNA-guided Cas9 nuclease.
CRISPR	Lawrenson T, Shorinola O, Stacey N, Li C, Østergaard L, Patron N, Uauy C, Harwood W. Genome Biol. 2015 Nov 30;16:258. doi: 10.1186/s13059-015-0826-7.
2015 15	soybean Nanjing Agricultural University, Nanjing, China
PMID:26603121	Efficient targeted mutagenesis in soybean by TALENs and CRISPR/Cas9.
TALEN/CRISPR	Du H, Zeng X, Zhao M, Cui X, Wang Q, Yang H, Cheng H, Yu D. J Biotechnol. 2015 Nov 18. doi:pii: S0168-1656(15)30178-4. 10.1016/j.jbiotec.2015.11.005. [Epub ahead of print]
2015 16	soybean University of Kentucky, Kentucky, USA
PMID:26582727	Rj4, a Gene Controlling Nodulation Specificity in Soybeans, Encodes a Thaumatin-Like Protein, but Not the One Previously Reported.
CRISPR	Tang F, Yang S, Liu J, Zhu H. Plant Physiol. 2015 Nov 18. doi:pii: pp.01661.2015. [Epub ahead of print]
2015 17	Arabidopsis, system Karlsruhe Institute of Technology, Karlsruhe, Germany.
PMID:26576927	Highly efficient heritable plant genome engineering using Cas9 orthologues from Streptococcus thermophilus and Staphylococcus aureus.
CRISPR	Steinert J, Schiml S, Fauser F, Puchta H. Plant J. 2015 Nov 18. doi: 10.1111/tpj.13078. [Epub ahead of print]

表3. NBT応用植物に関する文献調査結果(CRISPR) (その3)

Year	Applied plant species
ID	Affiliation, country
Identifiers	Title
Category	Description
	Details
2015 18 PMID:26556628 CRISPR	Nicotiana benthamiana King Abdullah University of Science and Technology, Saudi Arabia. CRISPR/Cas9-mediated viral interference in plants. Ali Z, Abulfaraj A, Idris A, Ali S, Tashkandi M, Mahfouz MM. Genome Biol. 2015 Nov 11;16(1):238. doi: 10.1186/s13059-015-0799-6.
2015 19 PMID:26541286 CRISPR	tomato University of Minnesota, Minneapolis, Minnesota, USA. High-frequency, precise modification of the tomato genome. Čermák T, Baltes NJ, Čegan R, Zhang Y, Voytas DF. Genome Biol. 2015 Nov 6;16(1):232. doi: 10.1186/s13059-015-0796-9.
2015 20 PMID:26524930 CRISPR	Arabidopsis Chinese Academy of Sciences, University of Chinese Academy of Sciences, Beijing, China. High efficiency genome editing in Arabidopsis using Yao promoter-driven CRISPR/Cas9 system. Yan L, Wei S, Wu Y, Hu R, Li H, Yang W, Xie Q. Mol Plant. 2015 Oct 22. doi:pii: S1674-2052(15)00399-8. 10.1016/j.molp.2015.10.004. [Epub ahead of print]
2015 21 PMID:26496757 CRISPR	Populus Southwest University, Chongqing, China. Highly efficient CRISPR/Cas9-mediated targeted mutagenesis of multiple genes in Populus. Tingting L, Di F, Lingyu R, Yuanzhong J, Rui L, Keming L. Yi Chuan. 2015 Oct 20;37(10):1044-52. doi: 10.16288/j.ycz.15-303.
2015 22 PMID:26482477 CRISPR	rice Anhui Academy of Agricultural Sciences, Hefei, China Identification of a regulatory element responsible for salt induction of rice OsRAV2 through ex situ and in situ promoter analysis. Duan YB, Li J, Qin RY, Xu RF, Li H, Yang YC, Ma H, Li L, Wei PC, Yang JB. Plant Mol Biol. 2015 Oct 19. [Epub ahead of print]
2015 23 PMID:26479970 CRISPR	soybean, Medicago truncatula University of Minnesota, MN, USA. CRISPR/Cas mutagenesis of soybean and Medicago truncatula using a new web-tool and a modified Cas9 enzyme. Michno JM, Wang X, Liu J, Curtin SJ, Kono TJ, Stupar RM. GM Crops Food. 2015 Oct 19:0. [Epub ahead of print]
2015 24 PMID:26479191 CRISPR	Arabidopsis, tobacco, lettuce, rice Institute for Basic Science, Seoul National University, Seoul, South Korea. DNA-free genome editing in plants with preassembled CRISPR-Cas9 ribonucleoproteins. Woo JW, Kim J, Kwon SI, Corvalán C, Cho SW, Kim H, Kim SG, Kim ST, Choe S, Kim JS. Nat Biotechnol. 2015 Nov;33(11):1162-4. doi: 10.1038/nbt.3389. Epub 2015 Oct 19.
2015 25 PMID:26450012 CRISPR	Nicotiana benthamiana Tsinghua University, Chinese Academy of Sciences, Beijing, China. A geminivirus-based guide RNA delivery system for CRISPR/Cas9 mediated plant genome editing. Yin K, Han T, Liu G, Chen T, Wang Y, Yu AY, Liu Y. Sci Rep. 2015 Oct 9;5:14926. doi: 10.1038/srep14926.
2015 26 PMID:26408904 CRISPR	tomato National Institute of Agrobiological Sciences, Japan CRISPR/Cas9-mediated mutagenesis of the RIN locus that regulates tomato fruit ripening. Ito Y, Nishizawa-Yokoi A, Endo M, Mikami M, Toki S. Biochem Biophys Res Commun. 2015 Nov 6;467(1):76-82. doi: 10.1016/j.bbrc.2015.09.117. Epub 2015 Sep 25.

表3. NBT応用植物に関する文献調査結果(CRISPR) (その4)

Year	Applied plant species
ID	Affiliation, country
Identifiers	Title
Category	Description
	Details
2015 27	Arabidopsis Chinese Academy of Sciences, Shanghai, China
PMID:26360626	Development of germ-line-specific CRISPR-Cas9 systems to improve the production of heritable gene modifications in Arabidopsis.
CRISPR	Mao Y, Zhang Z, Feng Z, Wei P, Zhang H, Botella JR, Zhu JK. Plant Biotechnol J. 2015 Sep 11. doi: 10.1111/pbi.12468. [Epub ahead of print]
2015 28	Nicotiana benthamiana, Arabidopsis, rice East Carolina University, North Carolina, USA
PMID:26297141	A CRISPR/Cas9 Toolbox for Multiplexed Plant Genome Editing and Transcriptional Regulation.
CRISPR	Lowder LG, Zhang D, Baltes NJ, Paul JW 3rd, Tang X, Zheng X, Voytas DF, Hsieh TF, Zhang Y, Qi Y. Plant Physiol. 2015 Oct;169(2):971-85. doi: 10.1104/pp.15.00636. Epub 2015 Aug 21.
2015 29	soybean DuPont Pioneer Agricultural Biotechnology, Delaware, USA
PMID:26294043	Cas9-Guide RNA Directed Genome Editing in Soybean.
CRISPR	Li Z, Liu ZB, Xing A, Moon BP, Koellhoffer JP, Huang L, Ward RT, Clifton E, Falco SC, Cigan AM. Plant Physiol. 2015 Oct;169(2):960-70. doi: 10.1104/pp.15.00783. Epub 2015 Aug 20.
2015 30	soybean DuPont Pioneer Agricultural Biotechnology, Delaware, USA
PMID:26294043	Cas9-Guide RNA Directed Genome Editing in Soybean.
CRISPR	Li Z, Liu ZB, Xing A, Moon BP, Koellhoffer JP, Huang L, Ward RT, Clifton E, Falco SC, Cigan AM. Plant Physiol. 2015 Oct;169(2):960-70. doi: 10.1104/pp.15.00783. Epub 2015 Aug 20.
2015 31	soybean Chinese Academy of Agricultural Sciences, Beijing, China.
PMID:26284791	CRISPR/Cas9-Mediated Genome Editing in Soybean Hairy Roots.
CRISPR	Cai Y, Chen L, Liu X, Sun S, Wu C, Jiang B, Han T, Hou W. PLoS One. 2015;10(8):e0136064. doi: 10.1371/journal.pone.0136064.
2015 32	corn DuPont Pioneer, Johnston, Iowa, USA
PMID:26269544	Targeted Mutagenesis, Precise Gene Editing, and Site-Specific Gene Insertion in Maize Using Cas9 and Guide RNA.
CRISPR	Svitashev S, Young JK, Schwartz C, Gao H, Falco SC, Cigan AM. Plant Physiol. 2015 Oct;169(2):931-45. doi: 10.1104/pp.15.00793. Epub 2015 Aug 12.
2015 33	Arabidopsis China Agricultural University, Beijing, China.
PMID:26193878	Egg cell-specific promoter-controlled CRISPR/Cas9 efficiently generates homozygous mutants for multiple target genes in Arabidopsis in a single generation.
CRISPR	Wang ZP, Xing HL, Dong L, Zhang HY, Han CY, Wang XC, Chen QJ. Genome Biol. 2015 Jul 21;16:144. doi: 10.1186/s13059-015-0715-0.
2015 34	Populus Chinese Academy of Sciences, Xining, China.
PMID:26193631	Efficient CRISPR/Cas9-mediated Targeted Mutagenesis in Populus in the First Generation.
CRISPR	Fan D, Liu T, Li C, Jiao B, Li S, Hou Y, Luo K. Sci Rep. 2015 Jul 20;5:12217. doi: 10.1038/srep12217.
2015 35	rice Yokohama City University, Yokohama, Japan.
PMID:26188471	Comparison of CRISPR/Cas9 expression constructs for efficient targeted mutagenesis in rice.
CRISPR	Mikami M, Toki S, Endo M. Plant Mol Biol. 2015 Aug;88(6):561-72. doi: 10.1007/s11103-015-0342-x. Epub 2015 Jul 19.
2015 36	rice National Institute of Agrobiological Sciences, Japan
PMID:26134856	Parameters affecting frequency of CRISPR/Cas9 mediated targeted mutagenesis in rice.
CRISPR	Mikami M, Toki S, Endo M. Plant Cell Rep. 2015 Oct;34(10):1807-15. doi: 10.1007/s00299-015-1826-5. Epub 2015 Jul 2.

表3. NBT応用植物に関する文献調査結果(CRISPR) (その5)

Year	Applied plant species
ID	Affiliation, country
Identifiers	Title
Category	Description
	Details
2015 37 PMID:26089199 CRISPR	rice Anhui Academy of Agricultural Sciences, Hefei, China. Generation of inheritable and "transgene clean" targeted genome-modified rice in later generations using the CRISPR/Cas9 system. Xu RF, Li H, Qin RY, Li J, Qiu CH, Yang YC, Ma H, Li L, Wei PC, Yang JB. Sci Rep. 2015 Jun 19;5:11491. doi: 10.1038/srep11491.
2015 38 PMID:26082432 CRISPR	potato Henan Agricultural University, Zhengzhou, China. Efficient targeted mutagenesis in potato by the CRISPR/Cas9 system. Wang S, Zhang S, Wang W, Xiong X, Meng F, Cui X. Plant Cell Rep. 2015 Sep;34(9):1473-6. doi: 10.1007/s00299-015-1816-7. Epub 2015 Jun 17.
2015 39 PMID:26039254 CRISPR	Nicotiana benthamiana King Abdullah University of Science and Technology, Saudi Arabia. Activity and specificity of TRV-mediated gene editing in plants. Ali Z, Abul-Faraj A, Piatek M, Mahfouz MM. Plant Signal Behav. 2015 Oct 3;10(10):e1044191. doi: 10.1080/15592324.2015.1044191. Epub 2015 Jun 3.
2015 40 PMID:25970829 CRISPR	Populus University of Georgia, GA, USA Exploiting SNPs for biallelic CRISPR mutations in the outcrossing woody perennial Populus reveals 4-coumarate:CoA ligase specificity and redundancy. Zhou X, Jacobs TB, Xue LJ, Harding SA, Tsai CJ. New Phytol. 2015 Oct;208(2):298-301. doi: 10.1111/nph.13470. Epub 2015 May 13.
2015 41 PMID:25917172 CRISPR	Arabidopsis, rice South China Agricultural University, Guangzhou, China. A Robust CRISPR/Cas9 System for Convenient, High-Efficiency Multiplex Genome Editing in Monocot and Dicot Plants. Ma X, Zhang Q, Zhu Q, Liu W, Chen Y, Qiu R, Wang B, Yang Z, Li H, Lin Y, Xie Y, Shen R, Chen S, Wang Z, Chen Y, Guo J, Chen L, Zhao X, Dong Z, Liu YG. Mol Plant. 2015 Aug;8(8):1274-84. doi: 10.1016/j.molp.2015.04.007. Epub 2015 Apr 24.
2015 42 PMID:25879861 CRISPR	soybean University of Georgia, Georgia, USA. Targeted genome modifications in soybean with CRISPR/Cas9. Jacobs TB, LaFayette PR, Schmitz RJ, Parrott WA. BMC Biotechnol. 2015 Mar 12;15:16. doi: 10.1186/s12896-015-0131-2.
2015 43 PMID:25757776 CRISPR	Arabidopsis, Nicotiana benthamiana Massachusetts General Hospital, Boston, MA, USA Targeted plant genome editing via the CRISPR/Cas9 technology. Li JF, Zhang D, Sheen J. Methods Mol Biol. 2015;1284:239-55. doi: 10.1007/978-1-4939-2444-8_12.
2015 44 PMID:25749112 CRISPR	plants(unknown) King Abdullah University of Science and Technology, Saudi Arabia. Efficient Virus-Mediated Genome Editing in Plants Using the CRISPR/Cas9 System. Ali Z, Abul-faraj A, Li L, Ghosh N, Piatek M, Mahjoub A, Aouida M, Piatek A, Baltes NJ, Voytas DF, Dinesh-Kumar S, Mahfouz MM. Mol Plant. 2015 Aug;8(8):1288-91. doi: 10.1016/j.molp.2015.02.011. Epub 2015 Mar 6.
2015 45 PMID:25733849 CRISPR	rice Pennsylvania State University, PA, USA Boosting CRISPR/Cas9 multiplex editing capability with the endogenous tRNA-processing system. Xie K, Minkenberg B, Yang Y. Proc Natl Acad Sci U S A. 2015 Mar 17;112(11):3570-5. doi: 10.1073/pnas.1420294112. Epub 2015 Mar 2.

表3. NBT応用植物に関する文献調査結果(CRISPR) (その6)

Year	Applied plant species
ID	Affiliation, country
Identifiers	Title
Category	Description
	Details
2015 46 PMID:25646447 CRISPR	Arabidopsis University of California, CA, USA Auxin binding protein 1 (ABP1) is not required for either auxin signaling or Arabidopsis development. Gao Y, Zhang Y, Zhang D, Dai X, Estelle M, Zhao Y. Proc Natl Acad Sci U S A. 2015 Feb 17;112(7):2275-80. doi: 10.1073/pnas.1500365112. Epub 2015 Feb 2.
2015 47 PMID:25578968 CRISPR	Arabidopsis National Institute of Biological Sciences, Beijing, China Two novel NAC transcription factors regulate gene expression and flowering time by associating with the histone demethylase JMJ14. Ning YQ, Ma ZY, Huang HW, Mo H, Zhao TT, Li L, Cai T, Chen S, Ma L, He XJ. Nucleic Acids Res. 2015 Jan 10. doi:pil: gku1382. [Epub ahead of print]
2014 48 PMID:25403732 CRISPR/TALEN	Nicotiana benthamiana, Arabidopsis Weizmann Institute of Science, Rehovot, Israel Comparative assessments of CRISPR-Cas nucleases' cleavage efficiency in planta. Johnson RA, Gurevich V, Filler S, Samach A, Levy AA. Plant Mol Biol. 2015 Jan;87(1-2):143-56. doi: 10.1007/s11103-014-0266-x. Epub 2014 Nov 18.
2014 49 PMID:25400128 CRISPR	plants(unknown) King Abdullah University of Science and Technology, Saudi Arabia. RNA-guided transcriptional regulation in planta via synthetic dCas9-based transcription factors. Piatek A, Ali Z, Baazim H, Li L, Abulfaraj A, Al-Shareef S, Aouida M, Mahfouz MM. Plant Biotechnol J. 2015 May;13(4):578-89. doi: 10.1111/pbi.12284. Epub 2014 Nov 14.
2014 50 PMID:25344637 CRISPR	tobacco Southwest University, Chongqing, China CRISPR/Cas9-mediated targeted mutagenesis in Nicotiana tabacum. Gao J, Wang G, Ma S, Xie X, Wu X, Zhang X, Wu Y, Zhao P, Xia Q. Plant Mol Biol. 2015 Jan;87(1-2):99-110. doi: 10.1007/s11103-014-0263-0. Epub 2014 Oct 26.
2014 51 PMID:25269397 CRISPR	Arabidopsis Max Planck Institute for Plant Breeding Research, Cologne, Germany Site-directed mutagenesis in Arabidopsis thaliana using dividing tissue-targeted RGEN of the CRISPR/Cas system to generate heritable null alleles. Hyun Y, Kim J, Cho SW, Choi Y, Kim JS, Coupland G. Planta. 2015 Jan;241(1):271-84. doi: 10.1007/s00425-014-2180-5. Epub 2014 Oct 1.
2014 52 PMID:25432517 CRISPR	corn, Arabidopsis China Agricultural University, Beijing, China A CRISPR/Cas9 toolkit for multiplex genome editing in plants. Xing HL, Dong L, Wang ZP, Zhang HY, Han CY, Liu B, Wang XC, Chen QJ. BMC Plant Biol. 2014 Nov 29;14(1):327. [Epub ahead of print]
2014 53 PMID:25398353 CRISPR	Arabidopsis, tobacco Harvard Medical School, Boston, Massachusetts, USA Cas9-based genome editing in Arabidopsis and tobacco. Li JF, Zhang D, Sheen J. Methods Enzymol. 2014;546:459-72. doi: 10.1016/B978-0-12-801185-0.00022-2.
2014 54 PMID:25392068 CRISPR	rice NIAS, Tsukuba, Japan Multigene Knockout Utilizing Off-Target Mutations of the CRISPR/Cas9 System in Rice. Endo M, Mikami M, Toki S. Plant Cell Physiol. 2014 Nov 11. doi:pil: pcu154. [Epub ahead of print]
2014 55 PMID:25327456 CRISPR	Arabidopsis Karlsruhe Institute of Technology, Karlsruhe, Germany The CRISPR/Cas system can be used as nuclease for in planta gene targeting and as paired nickases for directed mutagenesis in Arabidopsis resulting in heritable progeny. Schiml S, Fauser F, Puchta H. Plant J. 2014 Dec;80(6):1139-50. doi: 10.1111/tpj.12704. Epub 2014 Nov 11.

表3. NBT応用植物に関する文献調査結果(CRISPR) (その7)

Year	Applied plant species
ID	Affiliation, country
Identifiers	Title
Category	Description
	Details
2014 56 PMID:25232936 CRISPR	rice, wheat Chinese Academy of Sciences, Beijing, China Genome editing in rice and wheat using the CRISPR/Cas system. Shan Q, Wang Y, Li J, Gao C. Nat Protoc. 2014 Oct;9(10):2395-410. doi: 10.1038/nprot.2014.157. Epub 2014 Sep 18.
2014 57 PMID:25225186 CRISPR	tomato Boyce Thompson Institute for Plant Science, NY, USA Efficient gene editing in tomato in the first generation using the clustered regularly interspaced short palindromic repeats/CRISPR-associated9 system. Brooks C, Nekrasov V, Lippman ZB, Van Eck J. Plant Physiol. 2014 Nov;166(3):1292-7. doi: 10.1104/pp.114.247577. Epub 2014 Sep 15. No abstract available.
2014 58 PMID:25200087 CRISPR	rice Iowa State University, Ames, IA, USA Large chromosomal deletions and heritable small genetic changes induced by CRISPR/Cas9 in rice. Zhou H, Liu B, Weeks DP, Spalding MH, Yang B. Nucleic Acids Res. 2014;42(17):10903-14. doi: 10.1093/nar/gku806. Epub 2014 Sep 8.
2014 59 PMID:25146436 CRISPR	grapefruit University of Florida, FL, USA Xcc-facilitated agroinfiltration of citrus leaves: a tool for rapid functional analysis of transgenes in citrus leaves. Jia H, Wang N. Plant Cell Rep. 2014 Dec;33(12):1993-2001. doi: 10.1007/s00299-014-1673-9. Epub 2014 Aug 22.
2014 60 PMID:25038773 CRISPR/TALEN	bread wheat Chinese Academy of Sciences, Beijing, China Simultaneous editing of three homoeoalleles in hexaploid bread wheat confers heritable resistance to powdery mildew. Wang Y, Cheng X, Shan Q, Zhang Y, Liu J, Gao C, Qiu JL. Nat Biotechnol. 2014 Sep;32(9):947-51. doi: 10.1038/nbt.2969. Epub 2014 Jul 20.
2014 61 PMID:24920971 CRISPR	rice Anhui University, Hefei, China Gene targeting using the Agrobacterium tumefaciens-mediated CRISPR-Cas system in rice. Xu R, Li H, Qin R, Wang L, Li L, Wei P, Yang J. Rice (N Y). 2014;7(1):5. doi: 10.1186/s12284-014-0005-6.
2014 62 PMID:24918588 CRISPR	Arabidopsis University of Nebraska, Nebraska, USA Efficient CRISPR/Cas9-mediated gene editing in Arabidopsis thaliana and inheritance of modified genes in the T2 and T3 generations. Jiang W, Yang B, Weeks DP. PLoS One. 2014;9(6):e99225. doi: 10.1371/journal.pone.0099225.
2014 63 PMID:24868032 CRISPR	tomato, Arabidopsis University of California, Davis, California, USA Hairy root transformation using Agrobacterium rhizogenes as a tool for exploring cell type-specific gene expression and function using tomato as a model. Ron M, Kajala K, Pauluzzi G, Wang D, Reynoso MA, Zumstein K, Garcha J, Winte S, Masson H, Inagaki S, Federici F, Sinha N, Deal RB, Bailey-Serres J, Brady SM. Plant Physiol. 2014 Oct;166(2):455-69. doi: 10.1104/pp.114.239392. Epub 2014 May 27.
2014 64 PMID:24854982 CRISPR	rice Chinese Academy of Sciences, Shanghai, China The CRISPR/Cas9 system produces specific and homozygous targeted gene editing in rice in one generation. Zhang H, Zhang J, Wei P, Zhang B, Gou F, Feng Z, Mao Y, Yang L, Zhang H, Xu N, Zhu JK. Plant Biotechnol J. 2014 Aug;12(6):797-807. doi: 10.1111/pbi.12200. Epub 2014 May 23.

表3. NBT応用植物に関する文献調査結果(CRISPR) (その8)

Year	Applied plant species
ID	Affiliation, country
Identifiers	Title
Category	Description
	Details
2014 65 PMID:24836556 CRISPR	Arabidopsis Karlsruhe Institute of Technology, Karlsruhe, Germany Both CRISPR/Cas-based nucleases and nickases can be used efficiently for genome engineering in Arabidopsis thaliana. Fauser F, Schiml S, Puchta H. Plant J. 2014 Jul;79(2):348-59. doi: 10.1111/tpj.12554. Epub 2014 Jun 17.
2014 66 PMID:24710347 CRISPR	sweet orange University of Florida, Fl, USA Targeted genome editing of sweet orange using Cas9/sgRNA. Jia H, Wang N. PLoS One. 2014;9(4):e93806. doi: 10.1371/journal.pone.0093806.
2014 67 PMID:24576457 CRISPR/TALEN	corn Chinese Academy of Sciences, Beijing, China Targeted mutagenesis in Zea mays using TALENs and the CRISPR/Cas system. Liang Z, Zhang K, Chen K, Gao C. J Genet Genomics. 2014 Feb 20;41(2):63-8. doi: 10.1016/j.jgg.2013.12.001. Epub 2013 Dec 14.
2014 68 PMID:24550464 CRISPR	Arabidopsis Chinese Academy of Sciences, Shanghai, China Multigeneration analysis reveals the inheritance, specificity, and patterns of CRISPR/Cas-induced gene modifications in Arabidopsis. Feng Z, Mao Y, Xu N, Zhang B, Wei P, Yang DL, Wang Z, Zhang Z, Zheng R, Yang L, Zeng L, Liu X, Zhu JK. Proc Natl Acad Sci U S A. 2014 Mar 25;111(12):4632-7. doi: 10.1073/pnas.1400822111. Epub 2014 Feb 18.
2014 69 PMID:24443494 CRISPR	liverwort Kyoto University, Kyoto, Japan CRISPR/Cas9-mediated targeted mutagenesis in the liverwort Marchantia polymorpha L. Sugano SS, Shirakawa M, Takagi J, Matsuda Y, Shimada T, Hara-Nishimura I, Kohchi T. Plant Cell Physiol. 2014 Mar;55(3):475-81. doi: 10.1093/pcp/pcu014. Epub 2014 Jan 18.
2013 70 PMID:24122057 CRISPR	wheat National Agri-Food Biotechnology Institute, Government of India, India RNA-guided genome editing for target gene mutations in wheat. Upadhyay SK, Kumar J, Alok A, Tuli R. G3 (Bethesda). 2013 Dec 9;3(12):2233-8. doi: 10.1534/g3.113.008847.
2013 71 PMID:23999856 CRISPR	rice Peking University, Beijing, China Targeted mutagenesis in rice using CRISPR-Cas system. Miao J, Guo D, Zhang J, Huang Q, Qin G, Zhang X, Wan J, Gu H, Qu LJ. Cell Res. 2013 Oct;23(10):1233-6. doi: 10.1038/cr.2013.123. Epub 2013 Sep 3. No abstract available.
2013 72 PMID:23999092 CRISPR	Arabidopsis, tobacco, sorghum, rice Iowa State University, IA, USA Demonstration of CRISPR/Cas9/sgRNA-mediated targeted gene modification in Arabidopsis, tobacco, sorghum and rice. Jiang W, Zhou H, Bi H, Fromm M, Yang B, Weeks DP. Nucleic Acids Res. 2013 Nov;41(20):e188. doi: 10.1093/nar/gkt780. Epub 2013 Sep 2.
2013 73 PMID:23963532 CRISPR	Arabidopsis, rice Chinese Academy of Sciences, Shanghai, China Application of the CRISPR-Cas system for efficient genome engineering in plants. Mao Y, Zhang H, Xu N, Zhang B, Gou F, Zhu JK. Mol Plant. 2013 Nov;6(6):2008-11. doi: 10.1093/mp/sst121. Epub 2013 Aug 22. No abstract available.

表3. NBT応用植物に関する文献調査結果(CRISPR) (その9)