Table 1: Genome editing in plants to modify agronomically relevant traits (1996 - June 2019).

Plant	Producer, Country	Trait	Spezifikation	Technique	Reference
Cotton	Anhui Agricultural University, China; Chinese Academy of Agricultural Sciences, China	Growth performance	Increased root growth under high- and low N-conditions	CRISPR/Cas9 SDN1	[3]
Cucumber	Chinese Academy of Agricultural Sciences, China	Growth performance	Only female flowers	CRISPR/Cas9 SDN1	[4]
Potato	Cellectis Plant Science, USA	Storage performance	Improved cold storage and frying conditions (reduced sugar/ reduced acrylamide)	TALENs SDN1	[5]
Kiwi	The New Zealand Institute for Plant & Food Research Limited, New Zealand	Growth performance	Compact growth, early flowering	CRISPR/Cas9 SDN1	[6]
Maize	Benson Hill Biosystems, USA	Yield increase	Improved photosynthesis efficiency	Meganuclease SDN3	[7]
Maize	University of Wisconsin, USA	Growth performance	Early flowering under long day conditions	CRISPR/Cas9 SDN1	[8]
Canola	Christian-Albrechts-Universität Kiel, Germany	Yield increase	Scatter resistance	CRISPR/Cas9 SDN1	[9]
Canola	Huazhong Agricultural University, China	Yield increase	Increased seed number/pod, higher grain weight	CRISPR/Cas9 SDN1	[10]
Canola	Huazhong Agricultural University,China	Growth performance	Changed leaf shape	CRISPR/Cas9 SDN1	[11]
Canola	Hunan Agricultural University, China; Universite de Strasbourg, France	Growth performance	Early flowering	CRISPR/Cas9 SDN1	[12]
Rice	Chinese Academy of Sciences, China	Yield increase	Increased seed number/panicle	CRISPR/Cas9 SDN1	[13, 14]
	National Rice Research Institute, China			CRISPR/Cas9 SDN1	[15]
	Wuhan Institute of Bioengineering, China			CRISPR/Cas9 SDN1	[16]
Rice	Chinese Academy of Sciences, China	Yield increase	Higher Grain size and weight / Thousand seed weight	CRISPR/Cas9 SDN1	[13]
	Anhui Academy of Agricultural Sciences, China			CRISPR/Cas9 SDN1	[17]
	Fudan University, China			CRISPR/Cas9 SDN1	[18]
	Yangzhou University, China			CRISPR/Cas9 SDN1	[19, 20]
	Agronomy College of Henan Agricultural University, China			CRISPR/Cas9 SDN1	[21]

Plant	Producer, Country	Trait	Spezifikation	Technique	Reference
	Chinese Academy of Agricultural Sciences, China; Yangzhou University, China			CRISPR/Cas9 SDN1	[22]
	Okayama University, Henan Agricultural University China			CRISPR/Cas9 SDN1	[23–25]
	University of Maryland, USA			CRISPR/Cas9 SDN1	[26]
Rice	Chinese Academy of Sciences, China	Growth performance	Larger plants, improved tillering, upright panicles, increased biomass	CRISPR/Cas9; SDN1	[13]
	Wuhan Institute of Bioengineering; Huazhong Agricultural University, China			CRISPR/Cas9 SDN1	[27]
	Sichuan Agricultural University, China			CRISPR/Cas9 SDN1	[28]
	Chinese Academy of Agricultural Sciences, China; Yangzhou University, China			CRISPR/Cas9 SDN1	[22]
Rice	Chinese Academy of Sciences, China Rice Research Institute of Shenyang Agricultural University, Shenyang, China	Growth performance	Early flowering	CRISPR/Cas9 SDN1	[29, 30]
Rice	Chinese Academy of Agricultural Sciences, China; Jangsu Academy of Agricultural Sciences, China	Growth performance	Early ripening	CRISPR/Cas9 SDN1	[31]
Rice	King Abdullah University of Science and Technology, Saudi-Arabia	Growth performance	improved tillering, reduced plant height	CRISPR/Cas9 SDN1	[32]
Rice	Chinese Academy of Sciences, China; University of Chinese Academy of Sciences, China	Yield increase	Regulation of pollen growth	CRISPR/Cas9 SDN1	[33]
Rice	China Agricultural University, China	Storage performance	Longevity of seeds	TALENs SDN1	[34]
Rice	Nanjing Agricultural University, China	Yield increase	Grain yield, Regulation of seed-development	CRISPR/Cas9 SDN1	[35]
Rice	Anhui Academy of Agricultural Sciences, China	Yield increase	Longer penicles	CRISPR/Cas9 SDN1	[17]
Rice	Chinese Academy of Sciences, China	Growth performance	reduced plant height	BE SDN1	[36]
	Syngenta Biotechnology, China			CRISPR/Cas9 SDN1	[37]

Plant	Producer, Country	Trait	Spezifikation	Technique	Reference
Rice	Wuhan Institute of Bioengineering, China; Huazhong Agricultural University, China	Yield increase	Improved N-efficiency	CRISPR/Cas9 SDN1	[27]
Rice	Hunan Normal University, China	Growth performance	Dormancy regulation, stomata development, improved plant growth, abiotic Stress tolerance and senescence	CRISPR/Cas9 SDN1	[38]
Rice	Xiamen University, China	Growth performance	Red colored rice	CRISPR/Cas9 SDN1	[39]
Rice	Chinese Academy of Sciences, China	Growth performance	Increased leaf dispersion (increased surface)	CRISPR/Cas9 SDN1	[40]
Millet	Iowa State University, USA	Growth performance	bushy plants	CRISPR/Cas9 SDN1	[41]
Lettuce	University of California, USA	Yield increase	Increased germination under higher temp.	CRISPR/Cas9 SDN1	[42]
Soybean	Chinese Academy of Agricultural Sciences, China	Growth performance	late flowering	CRISPR/Cas9 SDN1	[43, 44]
Soybean	Chinese Academy of Agricultural Sciences, China	Growth performance/ Yield increase	late flowering under short-day conditions improved pod- and seed set/Plant	CRISPR/Cas9 SDN1	[45]
Soybean	University of Minnesota, USA	Growth performance	Changed petiole length	CRISPR/Cas9 SDN1	[46]
Tomato	National Food Research Institute, Japan Bioscience, Wageningen Plant Research, The Netherlands	Yield increase	Fast ripping fruits	CRISPR/Cas9 SDN1 CRISPR/Cas9 SDN1	[47] [48]
Tomato	University of Minnesota, USA	Growth performance	Bigger seedlings	TALENs SDN1	[49]
Tomato	Norwich Research Park, Great Britain	Growth performance	Dwarfism	CRISPR/Cas9 SDN1	[50]
Tomato	Cold Spring Harbor Laboratory, USA; Max Planck Institute for Plant Breeding Research, Germany; Université Paris-Scalay, France	Growth performance	Early flowering	CRISPR/Cas9 SDN1	[51]
Tomato	University of Florida, USA	Growth performance	Easier separation of the fruit from the stalk	CRISPR/Cas9 SDN1	[52]
Tomato	Cold Spring Harbor Laboratory, USA	Yield increase	Improved fruit size	CRISPR/Cas9 SDN1	[53]
Tomato	Cold Spring Harbor Laboratory, USA	Yield increase	Strongly branched inflorescences and formation of many flowers	CRISPR/Cas9 SDN1	[53]
Tomato	Weizmann Institute of Science, Israel	Growth performance	Yellow fruits	CRISPR/Cas9 SDN1	[54]

Plant	Producer, Country	Trait	Spezifikation	Technique	Reference
	Weizmann Institute of Science, Israel			CRISPR/Cas9 SDN3	[55]
	Agenzia Lucana per lo Sviluppo e l'Innovazione in Agricoltura, Italy			CRISPR/Cas9 SDN1	[56]
Tomato	Weizmann Institute of Science, Israel	Growth performance	Orange fruits	CRISPR/Cas9 SDN3	[55]
Tomato	Academy of Agriculture and Forestry Sciences; Chinese Academy of Sciences, China	Growth performance	Pink fruits	CRISPR/Cas9 SDN1	[57]
Wild strawberry	University of Maryland, USA;	Growth performance	Faster seedling development	CRISPR/Cas9 SDN1	[58]
Wheat	Kansas State University, USA; Norwich Research Park, GB	Yield increase	Larger grains, higher grain weight, higher thousand-grain weight	CRISPR/Cas9 SDN1	[59,]
	Kansas State University, USA			CRISPR/Cas9 SDN1	
	Chinese Academy of Sciences, China			CRISPR/Cas9 SDN1	[61]
Wheat	South Dakota State University, USA	Yield increase	Higher grain number per ear, increased grain weight per ear	CRISPR/Cas9 SDN1	[62]

BE: Base Editing
TALENs: Transcription Activator-Like Effector Nucleases
CRISPR/Cas9: Clustered Regularly Interspaced Short Palindromic Repeats/CRISPR associated protein 9
SDN: Site Directed Nucleases

Table 2: Genome editing to improve food or feed quality (1996 - June 2019).

Plant	Producer, Country	Trait	Specification	Technique	Reference
Field pennycress	Illinois State University, USA	Product quality	Changed oil composition	CRISPR/Cas9 SDN1	[63, 64]
Alfalfa	Calyxt, Inc., USA	Product quality	Reduced lignin content	TALENs SDN1	[65]
peanut	Guangdong Academy of Agricultural Sciences, China	Product quality	Increased oleic acid content, reduced linoleic acid content	TALENs SDN1	[66]
Millet	University of Nebraska, USA	Product quality	Improved digestibility of grain protein and modified lysine content	CRISPR/Cas9 SDN1	[67]
Potato	Calyxt, USA	Product quality	Non-browning	TALENs SDN1	[68]
Potato	Simplot Plant Science, USA	Product quality	Reduced black spotting	TALENs SDN1	[69]
Potato	RIKEN Center for Sustainable Resource Science, Japan; Chiba University, Japan	Product quality	Reduced glycoalcaloides	TALENs SDN1	[70]

Plant	Producer, Country	Trait	Specification	Technique	Reference
	Kobe University, Japan		Elimination of glycoalcaloides	CRISPR/Cas9 SDN1	[71]
Camelina	Montana State University, USA	Product quality	Higher oleic acid and α linolenic acid content	CRISPR/Cas9 SDN1	[72]
	University Nebraska, USA		Higher oleic acid content, lower fatty acid content	CRISPR/Cas9 SDN1	[73]
	Université Paris-Saclay, France		Higher oleic acid content, lower fatty acid content	CRISPR/Cas9 SDN1	[74]
	Kansas State University, USA		Reduced oil content	CRISPR/Cas9 SDN1	[75]
	Rothamsted Research, UK		Higher oleic acid content, lower fatty acid content	CRISPR/Cas9 SDN1	[76]
Maize	Du Pont Pioneer, USA;	Product quality	Waxycorn, modified starch composition	CRISPR/Cas9 SDN1	[77]
	Chinese Academy of Agricultural Sciences, China			CRISPR/Cas9 SDN1	[78]
Maize	Agrivida, USA	Product quality	Higher starch content in leaves and stems	Meganuc-lease SDN1	[79]
Maize	Chinese Academy of Agricultural Sciences, China	Product quality	Higher sugar content in grains	CRISPR/Cas9 SDN1	[80]
Cassava	ETH Zurich, Schweiz; University of Liege, Belgium	Product quality	modified starch composition	CRISPR/Cas9 SDN1	[81]
Agaricus	Penn State University, USA	Product quality	Non browning	CRISPR/Cas9 SDN1	[82]
Canola	Tamagawa University, Japan	Product quality	Changed oil composition	CRISPR/Cas9 SDN1	[83]
Rice	Chinese Academy of Sciences, China	Product quality	Scented rice	TALENs SDN1	[84]
	Chinese Academy of Agricultural Sciences, China; Yangzhou University, China			CRISPR/Cas9 SDN1	[22]
Rice	Chinese Academy of Agricultural Sciences, China; University of California, USA	Product quality	Changed starch content (increased amylose content)	CRISPR/Cas9 SDN1	[85]
Rice	Guangxi University, Jiangsu Academy of Agricultural Sciences, China	Product quality	Changed starch content (reduced amylose content)	CRISPR/Cas9 SDN1	[86, 87]
	University of Lleida-Agrotecnio Center, Spain				[88]
Rice	Huazhong Agricultural University, China	Product quality		CRISPR/Cas9 SDN1	[89]

Plant	Producer, Country	Trait	Specification	Technique	Reference
	Sun Yat-sen University, China		Reduction of ingredients harmful to health (arsenic content)	CRISPR/Cas9 SDN1	[90]
Rice	National Agriculture and Food Research Organization, Japan	Product quality	Changed oil composition	CRISPR/Cas9 SDN1	[91]
Rice	Université Montpellier, France	Product quality	Reduction of ingredients harmful to health (caesium content)	CRISPR/Cas9 SDN1	[92]
Rice	Hunan Agricultural University, Hunan Hybrid Rice Research Center, Normal University, China	Product quality	Reduction of ingredients harmful to health (cadmium content)	CRISPR/Cas9 SDN1	[93]
Rice	Chinese Academy of Sciences, Shanghai, China; Purdue University, West Lafayette, USA	Product quality	Waxy rice	CRISPR/Cas9 SDN1	[94]
Salvia	Second Military Medical University, China	Product quality	Reduction of phenolic acid content	CRISPR/Cas9 SDN1	[95]
Lettuce	Chinese Academy of Sciences, China	Product quality	Increased ascorbic acid content, improved tolerance to oxidative stress	CRISPR/Cas9 SDN1	[96]
Lettuce	Ag Bio Division, USA	Product quality	Reduced/ slowed browning of leaves	CRISPR/Cas9 SDN1	[97]
Poppy	Cankiri Karatekin University, Türkei; Dokuz Eylul University, Turkey	Product quality	Reduced morphine and thebain content	CRISPR/Cas9 SDN1	[98]
Soybean	Cellectis plant science Inc., USA/Calyxt, USA Jilin Agricultural University, China	Product quality	High oleic acid content, low linoleic acid content	TALENs SDN1 CRISPR/Cas9 SDN1	[99–102] [103]
Tomato	Agricultural Research Organization, Israel; Tokushima University, Japan	Product quality	Seedless fruits	CRISPR/Cas9 SDN1 CRISPR/Cas9 SDN1	[104] [105]
Tomato	University of Tsukuba, Japan; China Agricultural University, China	Product quality	Increase of health-promoting ingredients (increased GABA content)	CRISPR/Cas9 SDN1 CRISPR/Cas9 SDN1	[106] [107]
Tomato	China Agricultural University, China	Product quality	Increase of health-promoting ingredients (increased lycopene content)	CRISPR/Cas9 SDN1	[108]
Tomato	Xinjiang Academy of Agricultural Science, China	Product quality	Longer storage at room temperature	CRISPR/Cas9 SDN1	[109]
Wheat	Okayama University, Japan	Product quality	Longer seed dormancy (prevents germination before harvest)	CRISPR/Cas9 SDN1	[110]

Plant	Producer, Country	Trait	Specification	Technique	Reference
Wheat	Calyxt, Inc., USA	Product quality	Higher nutritional value	TALENs SDN1	[111]
Wheat	Instituto de Agricultura Sostenible (IAS-CSIC), Spain; University of Minnesota, USA	Product quality	Reduced gluten content	CRISPR/Cas9 SDN1	[112]
Wheat (Durum)	Instituto de Agricultura Sostenible (IAS-CSIC), Spain; University of Minnesota, USA	Product quality	Reduced gluten content	CRISPR/Cas9 SDN1	[112]

TALENs: Transcription Activator-Like Effector Nucleases
CRISPR/Cas9: Clustered Regularly Interspaced Short Palindromic Repeats/CRISPR associated protein 9
SDN: Site Directed Nucleases

Table 3: Genome editing in plants to improve resistance/tolerance to biotic stress (1996 - June 2019).

Plant	Producer, Country	Trait	Specification	Technique	Reference
Banana	International Institute of Tropical Agriculture (IITA), Kenia	Virus resistance	Resistance against *Banana Streak Virus* (BSV)	CRISPR/Cas9 SDN1	[113]
Cotton	Chinese Academy of Sciences; Chinese Academy of agricultural Sciences, China	Fungi resistance	Resistance against *Verticillium dahlia*	CRISPR/Cas9 SDN1	[114]
Barley	Agricultural Biotechnology Institute, Hungary	Virus resistance	Resistance against *Wheat Dwarf Virus*	CRISPR/Cas9 SDN1	[115]
Grapefruit	University of Florida, USA; Gannan Normal University, China	Resistance against bacteria	Citrus cancer resistance	CRISPR/Cas9 SDN1 CRISPR/Cpf1 SDN1	[116, 117] [118]
Cucumber	Volcani Center, Israel	Virus resistance	Immunity to Cucumber Vein Yellowing Virus infection (Ipomovirus) and resistance to Potyvirus, Zucchini Yellow Mosaic Virus and Papaya Ring Spot Mosaic Virus-W.	CRISPR/Cas9 SDN1	[119]
cacao	Pennsylvania State University, USA	Fungi resistance	*Phytophthora tropicalis* resistance	CRISPR/Cas9 SDN1	[120]
Potato	Doka Gene Technologies Ltd; Moscow State University, Russia Hubei University, China; Max-Planck-Institut für Molekulare Plant physiology, Germany	Virus resistance	*Potato Virus Y* (PVY) resistance	CRISPR/Cas9 SDN1 CRISPR/Cas13a SDN1	[121] [122]
Maize	Du Pont Pioneer, USA	Fungi resistance	*Northern Leaf Blight* resistance	CRISPR/Cas9 (Cisgenesis) SDN3	[123]
Cassava	Donald Danforth Plant Science Center, USA	Virus resistance	Resistance to brown streak disease	CRISPR/Cas9 SDN1	[124]

Plant	Producer, Country	Trait	Specification	Technique	Reference
Orange	Chinese Academy of Agricultural Sciences and National Center for Citrus Variety Improvement; Southwest University, China	Resistance against bacteria	Citrus cancer resistance	CRISPR/Cas9 SDN1	[125]
Canola	Yangzhou University, China	Fungi resistance	*Sclerotinia sclerotiorium* resistance	CRISPR/Cas9 SDN1	[126]
Rice	Chinese Academy of Agriculture, China	Fungi resistance	Resistance to rice browning	CRISPR/Cas9; SDN1	[127]
Rice	Huazhong Agricultural University, China	Fungi resistance	Resistance to rice browning, early earing	CRISPR/Cas9; SDN1	[128, 129]
Rice	Iowa State University, USA	Resistance against bacteria	Resistance against bacterial blight	CRISPR/Cas9; SDN1	[130]
	IRD-CIRAD- Université, France			TALENs SDN1	[131]
	Iowa State University, USA			TALENs SDN1	[132] [133]
	National University of Singapore, Singapure			TALENs SDN1	[134]
	Chinese Academy of Sciences, China			TALENs SDN1	[129, 135]
	National Center for Plant Gene Research, China; Sichuan Agricultural University, China			CRISPR/Cas9; SDN1	[136]
	Sichuan Agricultural University, China			CRISPR/Cas9 SDN1	[28]
Rice	Shanghai Jiao Tong University, China; Yunnan Academy of Agricultural Sciences, China	Resistance against bacteria	*Xanthomonas RS105* Resistance	TALENs SDN1	[137]
Rice	International Rice Research Institute (IRRI), Philippines	Virus resistance	*Rice-Tungro- Virus* resistance	CRISPR/Cas9 SDN1	[138]
Rice	South China Agricultural University, Guangzhou, China	Virus resistance	*Southern Rice Black-streaked Dwarf Virus* resistance	CRISPR/Cas13a SDN1	[139]
Tomato	Max Planck Institute for Developmental Biology, Germany; Norwich Research Park, UK	Fungi resistance	Powdery mildew resistance	CRISPR/Cas9 SDN1	[140]
Tomato	King Abdullah University of Science and Technology, Saudi-Arabia	Virus resistance	*Tomato Yellow Leaf Virus* resistance	CRISPR/Cas9 SDN1	[141]
Tomato	University of California, USA	Resistance against bacteria	Multiple resistance e.g. *P. syringae, P. capsici und Xanthomonas spp.*	CRISPR/Cas9 SDN1	[142]

Plant	Producer, Country	Trait	Specification	Technique	Reference
Tomato	Consejo Superior de Investigaciones Científicas, Spain	Resistance against bacteria	leaf and fruit blotch disease resistance	CRISPR/Cas9 SDN1	[143]
Grapevine	Northwest A&F University and Ministry of Agriculture, China	Fungi resistance	Gray mold resistance	CRISPR/Cas9 SDN1	[144]
Wheat	Chinese Academy of Sciences, China	Fungi resistance	Powdery mildew resistance	TALENs SDN1	[145]
	Chinese Academy of Sciences, China			CRISPR/Cas9 SDN1	[146]

TALENs: Transcription Activator-Like Effector Nucleases
CRISPR/Cas9: Clustered Regularly Interspaced Short Palindromic Repeats/CRISPR associated protein 9
SDN: Site Directed Nucleases

Table 4: Genome editing for the production of herbicide-tolerant plants (1996 – Juni 2019).

Plant	Producer, Country	Trait*	Specification	Technique	Reference
Cotton	Bayer CropScience N.V., Belgium	Herbicide tolerance	-	Meganuclease SDN3	[147]
Linum	Cibus, USA	Herbicide tolerance	-	CRISPR/Cas9 SDN1	[148]
Potato	Michigan State University, USA	Herbicide tolerance	-	CRISPR/Cas9, TALENs SDN2	[149]
Maize	DuPont Pioneer, USA	Herbicide tolerance	-	CRISPR/Cas9 SDN1, SDN2, SDN3	[150, 151]
	Dow AgroScience, USA			ZFN SDN3	[152]
	Pioneer Hi-Bred International, USA			ODM	[153, 154]
Cassava	Donald Danforth Plant Science Center, St. Louis, USA	Herbicide tolerance	-	CRISPR/Cas9 SDN3	[155]
Canola	Cibus, Canada; Cibus, USA;	Herbicide tolerance	-	ODM	[156]
	Bayer BioScience N.V., Belgium				[157]
Rice	Chinese Academy of Sciences, China	Herbicide tolerance	-	CRISPR/Cas9 SDN2	[158]
	Chinese Academy of Sciences, China; Huazhong Agricultural University, China; University of California San Diego, USA;			CRISPR/Cas9 SDN2	[159]
	Zhejiang University, China			TALENs SDN2	[160]
	Tohoku University, Japan			ODM	[161]

Plant	Producer, Country	Trait*	Specification	Technique	Reference
	Kobe University, Japan; University of Tsukuba, Japan; Chinese academy of Science, China			BE	[162–164]
	King Abdullah University of Science and Technology, Saudi-Arabia			CRISPR/Cas9 SDN2	[165]
Soybean	DuPont Pioneer, USA	Herbicide tolerance	-	CRISPR/Cas9 SDN2	[166]
				CRISPR/Cas9 SDN3	[167]
Tomato	GAFL Unit (Génétique et Amelioration des Fruits et Légumes), France	Herbicide tolerance	-	CRISPR/Cas9 SDN1	[168]
Watermelon	China Agricultural University, China; Beijing Academy of Agriculture and Forestry Sciences, China	Herbicide tolerance	-	CRISPR/Cas9 SDN1	[169]
Wheat	Chinese Academy of Sciences, China Agricultural University, China	Herbicide tolerance	-	BE	[170]

* no detailed classification of chemical substances
TALENs: Transcription Activator-Like Effector Nucleases
CRISPR/Cas9: Clustered Regularly Interspaced Short Palindromic Repeats/CRISPR associated protein 9
ZFN: Zinc-Finger Nuclease
ODM: Oligonucleotide-Directed Mutagenesis
SDN: Site Directed Nucleases
BE: Base Editing

Table 5: Genome editing in plants for industrial use (1996 - June 2019).

Plant	Producer, Country	Trait	Specification	Technique	Reference
Potato	Swedish University of Agricultural Sciences, Sweden	Product quality	Improved starch quality	CRISPR/Cas9 SDN1	[171]
	Université Rennes, France			CRISPR/Cas9 SDN1	[172]
	Tokyo University of Science, Japan			CRISPR/Cas9 SDN1	[173]
Dandelion	Fraunhofer Institute for Molecular Biology and Applied Ecology, Germany	Growth performance	Higher biomass of roots, taproots, increased rubber and inulin content	CRISPR/Cas9	[174]
Millet	Noble Research Institute, USA	Product quality	Reduction of lignin	CRISPR/Cas9 SDN1	[175]
Tobacco	TU Dortmund University, Germany	Product quality	Reduced nicotine content	CRISPR/Cas9 SDN1	[176]

Plant	Producer, Country	Trait	Specification	Technique	Reference
Sugar cane	University of Florida, USA	Product quality	Reduction of lignin	TALENs SDN1	[177, 178]

CRISPR/Cas9: Clustered Regularly Interspaced Short Palindromic Repeats/CRISPR associated protein 9
TALENs: Transcription Activator-Like Effector Nucleases
SDN: Site Directed Nucleases

Table 6: Genome editing in plants to improve tolerance to abiotic stress (1996 - June 2019).

Plant	Producer, Country	Trait	Specification	Technique	Reference
Potato	Doka Gene Technologies Ltd; Moscow State University, Russia	Salt tolerance	-	CRISPR/Cas9 SDN1	[121]
Maize	Ghent University, Belgium; Center for Plant Systems Biology, Belgium; Jomo Kenyatta University of Agriculture and Technology, Kenia	Drough tolerance	-	CRISPR/Cas9 SDN1	[179]
	DuPont Pioneer, USA			CRISPR/Cas9 SDN3	[167, 180]
Rice	Anhui Academy of Agricultural Sciences, China	Salt tolerance	-	CRISPR/Cas9 SDN1	[181]
	Huazhong Agricultural University, China			CRISPR/Cas9 SDN1	[182]
Soybean	USDA-ARS, USA	Drough- and Salt tolerance	-	CRISPR/Cas9 SDN1	[183]
Wheat	Montana State University, USA	Drough tolerance	-	CRISPR/Cas9 SDN1	[184]

CRISPR/Cas9: Clustered Regularly Interspaced Short Palindromic Repeats/CRISPR associated protein 9
SDN: Site Directed Nucleases

Table 7: Applied genome editing on different traits, thus assignment to several categories (1996 - June 2019).

Plant	Producer, Country	Trait	Specification	Technique	Reference
Cabbage	Ministry of Education; Southwest University, China	Growth performance	Self-incompatibility, male sterility	CRISPR/Cas9 SDN1	[185]
Maize	Dow AgroScience, USA	Product quality, Herbicide tolerance	reduced Phytat-production, Herbicide tolerance	ZFN SDN3	[186, 187]
Physalis	Cold Spring Harbor; The Boyce Thompson Institute, USA;	Growth performance Yield increase	compact growth, increased flower production, bigger fruits	CRISPR/Cas9 SDN1	[188]
Rice	Chinese Academy of Sciences, China	Growth performance	Heterozygosity, clonal Seed propagation	CRISPR/Cas9	[189]

Plant	Producer, Country	Trait	Specification	Technique	Reference
Wild Tomato	Chinese Academy of Sciences, China	Growth performance, Yield increase, Product quality	Day lenght sensibility, shoot architecture, flower- and fruit production, higher Vitamin C-content	CRISPR/Cas9 SDN1	[190]
Wild Tomato	Universität Münster, Germany; Universidade de Sao Paulo, Brasil	Growth performance, Yield increase, Product quality	changed fruit shape, compact growth, increased fruit number, larger fruits, increased constitutional ingredients (higher Lycopincontent)	CRISPR/Cas9 SDN1	[191]

CRISPR/Cas9: Clustered Regularly Interspaced Short Palindromic Repeats/CRISPR associated protein 9
SDN: Site Directed Nucleases
ZFN: Zink-Finger Nukleasen

Table 8: Genome editing to improve plant breeding (1996 - June 2019).

Plant	Producer, Country	Trait	Specification	Technique	Reference
Potato	Chinese Academy of Agricultural Sciences, China	Growth performance	Self-incompatibility	CRISPR/Cas9 SDN1	[192]
	Michigan State University, USA			CRISPR/Cas9 SDN1	[193]
Maize	University of Science and Technology Beijing, China; Beijing Solidwill Sci-Tech Co. Ltd, China	Growth performance	male sterility	CRISPR/Cas9 SDN1	[194]
	Chinese Academy of Sciences, China			CRISPR/Cas9 SDN1	[23, 195, 196]
Maize	Syngenta Seeds, USA	Growth performance	Haploid induction	TALENs SDN1	[197]
	Syngenta Seeds, USA			CRISPR/Cas9 SDN1	[198]
	Chinese Academy of Agricultural Sciences, South China Agricultural University (Guangzhou),China Agricultural University (Beijing), China			CRISPR/Cas9 SDN1	[199, 200]
Rice	Kyung Hee University, South Korea	Growth performance	Male sterility	CRISPR/Cas9 SDN1	[201]
	Shanghai Jiao Tong University, China			CRISPR/Cas9 SDN1	[202, 203]
	South China Agricultural University, China			CRISPR/Cas9 SDN1	[204, 205]
	Sichuan Agricultural University, China			CRISPR/Cas9 SDN1	[206, 207]
	National Rice Research Institute, China			CRISPR/Cas9 SDN1	[208]
	Chinese Academy of Agricultural Sciences, China			CRISPR/Cas9 SDN1	[209]

Plant	Producer, Country	Trait	Specification	Technique	Reference
Rice	University of California; Iowa State University, USA	Growth performance	Asexual reproduction	CRISPR/Cas9 SDN1	[210]
Wheat	DuPont Pioneer, USA	Growth performance	Male sterility	CRISPR/Cas9 SDN1	[211]
	The University of Adelaide, Australia			CRISPR/Cas9 SDN1	[212]

CRISPR/Cas9: Clustered Regularly Interspaced Short Palindromic Repeats/CRISPR associated protein 9
SDN: Site Directed Nucleases

Table 9: Genome editing in ornamental plants (1996 - June 2019).

Plant	Producer, Country	Trait	Specification	Technique	Reference
Japanese morning glory	University of Tsukuba, Japan	Growth performance	Changed flower color	CRISPR/Cas9 SDN1	[213, 214]
Japanese morning glory	University of Tsukuba, Japan	Growth performance	increased flowering time	CRISPR/Cas9 SDN1	[215]
Orchid	Chinese Academy of Sciences, China	Product quality	Reduction of Lignocellulose (lignification)	CRISPR/Cas9 SDN1	[216]
Petunia	Kyungpook National University, South Korea	Growth performance	increased flowering time of individual flowers	CRISPR/Cas9 SDN1	[217]
Tobaccok	China Tobacco Gene Research Center, China	Growth performance	Auxin biosynthesis	CRISPR/Cas9 SDN1	[218]
Torenia	Iwate Biotechnology Research Center, Japan	Growth performance	Changed flower color	CRISPR/Cas9 SDN1	[219]

CRISPR/Cas9: Clustered Regularly Interspaced Short Palindromic Repeats/CRISPR associated protein 9
SDN: Site Directed Nuclease

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