

# Im Auftrag des Bundesamtes für Umwelt (BAFU)

## Tabellarische Übersichten

### **1. Welche Pflanzen, die mit Hilfe der neuen gentechnischen Verfahren entwickelt wurden:**

**befinden sich bereits im Anbau?**

**sind in der Entwicklungspipeline?**

### **2. Lizenzvereinbarungen im Bereich der neuen gentechnischen Verfahren:**

**zwischen**

**Züchtungsunternehmen**

**Biotech-Unternehmen**

**Forschungseinrichtungen/Universitäten**

**UPDATE: Dezember 2017**

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**Autorin:** Dr. Eva Gelinsky

**Begleitung BAFU:** Dr. Anne Gabrielle Wüst Saucy

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**Tabelle 1: Neue GV-Pflanzen, die bereits auf dem Markt sind  
und/oder in der Kommerzialisierungspipeline**

(UPDATE Stand: Dezember 2017, Neue Einträge sind unterstrichen)

Kultur	Pflanze (Sorte)	Verfahren <sup>a)</sup>	Eigenschaften	Unternehmen <sup>b)</sup>	Entwicklungsstatus <sup>c)</sup>	Freisetzungsversuche	Quelle
Raps	Siehe Endnote <sup>i</sup>	Rapid Trait Development System (RTDS™), <b>ODM</b>	Herbizidresistenz	<b>Cibus</b> (USA)	Zulassung USA (seit 2004), Kanada (seit 2014) <b>Anbau:</b> USA seit 2015, Kanada ab 2018	USA, Kanada (2011), Schweden (vor 2014), UK	1a, 2a, 41a, <u>47a</u>
Raps	Versch. Sorten, Clearfield-System	Rapid Trait Development System (RTDS™), <b>ODM</b>	Herbizidresistenz	<b>BASF</b> (D, USA), <b>Cibus</b> (USA) Zusammenarbeit seit 2007	Vermutlich im Anbau, USA	UK (2013)	17b, 60a
Raps		<b>TALEN</b>	Veränderte Fettsäurezusammensetzung	<b>Calyxt Inc.</b> (USA)	Forschung & Entwicklung (Phase I der Entwicklung abgeschlossen)	nein	29b, <u>57a</u>
Mais	Wachsmais	<b>CRISPR</b>	Wx1-Gen wurde ausgeschaltet: veränderte Stärkezusammensetzung	<b>DuPont Pioneer</b> (USA), <b>Caribou Biosciences</b> (USA)	Kommerzialisierung geplant <u>ab 2020</u>	USA, ab 2016	3a, 4a, 5, <u>48a</u>
Mais		<b>CRISPR</b>	Trockenheitstoleranz	<b>DuPont Pioneer</b> (USA), <b>Caribou Biosciences</b> (USA)	Kommerzialisierung geplant ab 2021	USA, ab 2016	7a, 8a, 31a

Kultur	Pflanze (Sorte)	Verfahren <sup>a)</sup>	Eigenschaften	Unternehmen <sup>b)</sup>	Entwicklungsstatus <sup>c)</sup>	Freisetzungsversuche	Quelle
Mais		EXZACT™ precision technology, ZFN	Herbizidresistenz, Veränderte Phytat-Biosynthese	Dow AgroScience (USA), Sangamo (USA)	Kurz vor der Kommerzialisierung oder ev. bereits im <b>Anbau</b> , weitere Pflanzen (u. a. Raps) in Entwicklung	unklar	1a, 19a, 20a, 21a, 40a
Lein		Rapid Trait Development System (RTDS™), ODM, TALEN, CRISPR	Herbizidresistenz (Glyphosat)	Cibus (USA)	Kommerzialisierung in den USA geplant ab 2020, in Kanada ab 2021	ab 2017	6a, 30a, 45a, 47a
Reis		Rapid Trait Development System (RTDS™), ODM	Herbizidresistenz	Cibus (USA)	Datum der Kommerzialisierung noch unklar – erst in den USA, dann in allen grossen Reis-Anbauländern	unklar	6a
Soja		TALEN	Veränderte Fettsäurezusammensetzung ( <i>High oleic</i> )	Calyxt Inc. (USA)	APHIS-Bescheid 2015, <b>Testanbau &amp; Saatgutvermehrung</b> findet bereits statt, Kommerzialisierung <b>ab Ende 2018</b>	Seit 2014 in den USA, Argentinien	15a, 16a, 17a, 39a, 43a, 44a, 49a
Soja		TALEN	Veränderte Fettsäurezusammensetzung (High oleic) & niedrige Linolensäure	Calyxt Inc. (USA)	APHIS-Bescheid 2015, <u>Phase II der Entwicklung abgeschlossen</u>	USA	42a, 43a, 44a
<u>Soja</u>	Bert	CRISPR	Trocken- und Salztoleranz	USDA-ARS, Plant Science Research Unit (USA)	APHIS-Bescheid 2017, Kommerzialisierung unklar	Geplant: Sand Plain Research Farm, Becker, Minnesota	49a, 54a

Kultur	Pflanze (Sorte)	Verfahren <sup>a)</sup>	Eigenschaften	Unternehmen <sup>b)</sup>	Entwicklungsstatus <sup>c)</sup>	Freisetzungsversuche	Quelle
Kartoffel	Innate™ 1 Generation & 2 Generation	Intragenese Cisgenese RNAi	Resistenz gegen Kraut- und Knollenfäule Weniger anfällig für grauschwarze Flecken (an Druckstellen), Weniger Acrylamide, Lagerung bei kühleren Temperaturen	<b>J.R. Simplot</b> (USA)	1. Generation: <b>Anbau</b> 2015: 160 Hektar, 2016: 800 Hektar (USA), in Kanada zugelassen 2. Generation: Zulassung USA (USDA), Kanada (Juli 2017) Anbau 1. & 2. Generation: 2500 ha (USA) Kommerzialisierung ab 2017	1 Generation: mehrere Jahre auf Prince Edward Island (Kanada)  2 Generation: über 2 Jahre an 11 Standorten (USA)	1a, 13a, 29a, 32a, 33a, 34a
Kartoffel		TALEN	Bessere Lagereigenschaften bei kühlen Temperaturen	<b>Calyxt Inc.</b> (USA)	Kommerzialisierung ab 2019, APHIS-Bescheid 2014	USA, ab 2015	22a, 23a, 24a, 36a
Kartoffel		TALEN	Weniger Acrylamid-Bildung beim Frittieren/ <i>non-browning</i>	<b>Calyxt Inc.</b> (USA)	APHIS-Bescheid 2016	nein	25a, 26a, 35a, 57a
Kartoffel		Rapid Trait Development System (RTDS™), ODM	Resistenz gegen Kraut- und Knollenfäule	<b>Cibus</b> (USA)	Kommerzialisierung USA geplant um 2020, danach in allen grossen Kartoffel-Anbauländern	unklar	6a
Kartoffel	Bintje	Cisgenese	Resistenz gegen Kraut- und Knollenfäule	Ghent University, Vlaams Instituut voor Biotechnologie (VIB), Institute for Agricultural and Fisheries Research (ILVO)	Kommerzialisierung unklar	nein	37a, 58a

Kultur	Pflanze (Sorte)	Verfahren <sup>a)</sup>	Eigenschaften	Unternehmen <sup>b)</sup>	Entwicklungsstatus <sup>c)</sup>	Freisetzungsversuche	Quelle
Kartoffel	Maris Piper	Cisgenese ev. RNAi	Resistenz gegen Kraut- und Knollenfäule, Kartoffelzysten-nematoden, geringere Anfälligkeit gegen Druckstellen	TSL Potato Partnership Project (The Sainsbury Laboratory), University of Leeds, <b>J. R. Simplot, BioPotatoes UK Ltd</b>	ev. Kommerzialisierung ab 2025	Freisetzungsversuche 2016 – 2019 (UK)	38a
Weizen		CRISPR	Hybridweizen	<b>DuPont Pioneer (USA), Caribou Biosciences (USA)</b>	Kommerzialisierung geplant ab 2021	USA, ab 2016	7a, 8a
Weizen	MLO_KO Weizen	TALEN	Mehltauresistenz	<b>Calyxt Inc. (USA)</b>	Forschung & Entwicklung (Phase II der Entwicklung abgeschlossen)	Ja	21b, 22b, <u>57a</u>
Apfel	Arctic Apple „Arctic Granny“ „Arctic Golden“ „Arctic Fuji“	Intragenese RNAi	Keine braune Verfärbung nach Anschneiden	<i>Okanagan Speciality Fruits</i> (seit 2015 zu <b>Intrexon</b> ) (USA)	<b>Anbau, Test-Kommerzialisierung der Früchte seit Herbst 2017 im mittleren Westen der USA</b>	USA, Kanada	1a, 13a, zum Arctic Fuji s. <u>28a, 59a</u>
Pilze	Weisser Champignon	CRISPR	Keine braune Verfärbung nach Anschneiden, verbessertes <i>Shelf-life</i>	Prof. Yinong Yang, Pennsylvania State University (USA)	Forschung & Entwicklung, Kommerzialisierung noch unklar (s. Quelle 18a)	unklar	9a, 10a, 18a
<u>Leindotter</u>		CRISPR	Erhöhter Ölgehalt	<b>Yield10 Bioscience, Metabolix Oilseeds, Inc. (USA, Kanada)</b>	APHIS-Bescheid 2017	Ja, bislang wohl im kleineren Masstab (USA)	49a, 50a, 51a

Kultur	Pflanze (Sorte)	Verfahren <sup>a)</sup>	Eigenschaften	Unternehmen <sup>b)</sup>	Entwicklungsstatus <sup>c)</sup>	Freisetzungsversuche	Quelle
Alfalfa		TALEN	Verbesserte Nährstoffzusammensetzung („KO-Alfalfa“)	<i>Calyxt Inc.</i> (USA), <b>S&amp;W Seed Company</b> (USA)	APHIS-Bescheid 2017	Unklar, eher nein (s. Quelle 52a)	49a,52a, 53a

#### Anmerkungen:

a) Verfahren – zur besseren Unterscheidbarkeit farbig markiert: ODM = Oligonukleotid-gerichtete Mutagenese / CRISPR = Clustered Regularly Interspaced Short Palindromic Repeats / ZFN = Zinkfinger-Nuklease-Verfahren / TALEN = Transcription activator-like effector nuclease / Intragenese / Cisgenese / RNAi = RNA-Interferenz

b) *Unternehmen* (kursiv) = *Entwickler der Technologie*; **Unternehmen** (fett) = **Anwender**; (kursiv und fett) = **Unternehmen & Entwickler**

c) Forschung & Entwicklung = angewandte Forschung (→ Kommerzialisierung wird wahrscheinlich angestrebt)

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Das Unternehmen DuPont Pioneer (seit dem 1. September Teil von DowDuPont bzw. Teil der DowDuPont Agriculture Division, s. Quelle 46a) hat seit 2017 eine eigene CRISPR Webseite, um über die Nutzung des Verfahrens durch das Unternehmen zu informieren: <http://crisprcas.pioneer.com/>

## Quellen

1a= Ricroch, A. E., Hénard-Damave, M.-C. 2015: Next biotech plants: new traits, crops, developers and technologies for addressing global challenges. In: Critical Reviews in Biotechnology. Published online: 2 February 2015, ISSN; 1549-7801.

Download unter: [www.ncbi.nlm.nih.gov/pubmed/25641327](http://www.ncbi.nlm.nih.gov/pubmed/25641327)

2a= [www.testbiotech.org/node/1433](http://www.testbiotech.org/node/1433)

3a= <http://www.pioneer.com/home/site/about/news-media/news-releases/template.CONTENT/guid.1DB8FB71-1117-9A56-E0B6-3EA6F85AAE92>

4a= [https://www.aphis.usda.gov/biotechnology/downloads/reg\\_loi/15-352-01\\_air\\_inquiry\\_cbidel.pdf](https://www.aphis.usda.gov/biotechnology/downloads/reg_loi/15-352-01_air_inquiry_cbidel.pdf)

5a= [https://www.aphis.usda.gov/biotechnology/downloads/reg\\_loi/15-352-01\\_air\\_response\\_signed.pdf](https://www.aphis.usda.gov/biotechnology/downloads/reg_loi/15-352-01_air_response_signed.pdf)

6a= <http://www.cibus.com/products.php>

7a= [www.nytimes.com/2015/11/15/magazine/the-crispr-quandary.html?\\_r=0](http://www.nytimes.com/2015/11/15/magazine/the-crispr-quandary.html?_r=0)

8a= [www.technologyreview.com/s/542311/dupont-predicts-crispr-plants-on-dinner-plates-in-five-years/](http://www.technologyreview.com/s/542311/dupont-predicts-crispr-plants-on-dinner-plates-in-five-years/)

9a= [https://www.aphis.usda.gov/biotechnology/downloads/reg\\_loi/15-321-01\\_air\\_inquiry.pdf](https://www.aphis.usda.gov/biotechnology/downloads/reg_loi/15-321-01_air_inquiry.pdf)

10a= [https://www.aphis.usda.gov/biotechnology/downloads/reg\\_loi/15-321-01\\_air\\_response\\_signed.pdf](https://www.aphis.usda.gov/biotechnology/downloads/reg_loi/15-321-01_air_response_signed.pdf)

11a= [www.isaaa.org/gmapprovaldatabase/event/default.asp?EventID=177](http://www.isaaa.org/gmapprovaldatabase/event/default.asp?EventID=177)

12a= [www.vistivegold.com/](http://www.vistivegold.com/)

13a= [www.transgen.de/lebensmittel/1475.kartoffeln-aepfel-usa-gentechnik.html](http://www.transgen.de/lebensmittel/1475.kartoffeln-aepfel-usa-gentechnik.html)

14a= <https://www.pioneer.com/home/site/about/news-media/news-releases/template.CONTENT/guid.8F199A5C-BCB5-82F4-3E0A-A4263F332FA7>

15a= [https://www.aphis.usda.gov/biotechnology/downloads/reg\\_loi/15-071-01air.pdf](https://www.aphis.usda.gov/biotechnology/downloads/reg_loi/15-071-01air.pdf)



- 16a= [https://www.aphis.usda.gov/biotechnology/downloads/reg\\_loi/15-071-01air\\_resp.pdf](https://www.aphis.usda.gov/biotechnology/downloads/reg_loi/15-071-01air_resp.pdf)
- 17a= [http://www.calyxt.com/wp-content/uploads/2016/05/PR-5.24.16\\_Calyxt\\_Argentina\\_Soybean.pdf](http://www.calyxt.com/wp-content/uploads/2016/05/PR-5.24.16_Calyxt_Argentina_Soybean.pdf)
- 18a= <https://www.technologyreview.com/s/601285/here-come-the-unregulated-gmos/>
- 19a= [https://www.aphis.usda.gov/biotechnology/downloads/reg\\_loi/DOW\\_ZFN\\_IPK1\\_052610.pdf](https://www.aphis.usda.gov/biotechnology/downloads/reg_loi/DOW_ZFN_IPK1_052610.pdf)
- 20a= [https://www.aphis.usda.gov/biotechnology/downloads/reg\\_loi/APHIS\\_response\\_DOW\\_ZFN\\_IPK1\\_030812.pdf](https://www.aphis.usda.gov/biotechnology/downloads/reg_loi/APHIS_response_DOW_ZFN_IPK1_030812.pdf)
- 21a= <http://www.nature.com/nature/journal/v459/n7245/full/nature07992.html>
- 22a= <http://www.calyxt.com/products/improved-quality-potato/>
- 23a= <https://www.technologyreview.com/s/536756/a-potato-made-with-gene-editing/>
- 24a= <http://www.capitalpress.com/Research/20160726/companys-gene-editing-pipeline-full-of-northwest-crops>
- 25a= [https://www.aphis.usda.gov/biotechnology/downloads/reg\\_loi/16-090-01\\_air\\_inquiry\\_cbidel.pdf](https://www.aphis.usda.gov/biotechnology/downloads/reg_loi/16-090-01_air_inquiry_cbidel.pdf)
- 26a= [https://www.aphis.usda.gov/biotechnology/downloads/reg\\_loi/16-090-01\\_air\\_response\\_signed.pdf](https://www.aphis.usda.gov/biotechnology/downloads/reg_loi/16-090-01_air_response_signed.pdf)
- 27a= [https://www.aphis.usda.gov/biotechnology/downloads/reg\\_loi/aphis\\_response\\_cellectis\\_potato.pdf](https://www.aphis.usda.gov/biotechnology/downloads/reg_loi/aphis_response_cellectis_potato.pdf)

On September 23, 2016, APHIS announced the availability of the final Determination and Finding of No Significant Impact (FONSI) of Arctic® Fuji, developed by Okanagan Specialty Fruits, Inc.:

28a=[https://www.aphis.usda.gov/aphis/ourfocus/biotechnology/sa\\_environmental\\_documents/sa\\_environmental\\_assessments/petition\\_extension\\_16-004-01p-osf-apple](https://www.aphis.usda.gov/aphis/ourfocus/biotechnology/sa_environmental_documents/sa_environmental_assessments/petition_extension_16-004-01p-osf-apple)

The U.S. Department of Agriculture's (USDA) Animal and Plant Health Inspection Service (APHIS) extended deregulation to two lines of genetically engineered (GE) potatoes developed by **J.R. Simplot Company** for late blight resistance, low acrylamide potential, reduced black spot bruising, and lowered reducing sugars on October 28, 2016. APHIS previously reviewed and deregulated these GE traits in other GE potatoes:

29a= [https://www.aphis.usda.gov/aphis/ourfocus/biotechnology/sa\\_environmental\\_documents/sa\\_environmental\\_assessments/simplot\\_x17\\_y9\\_ext](https://www.aphis.usda.gov/aphis/ourfocus/biotechnology/sa_environmental_documents/sa_environmental_assessments/simplot_x17_y9_ext)

- 30a= [http://www.cibus.com/press\\_release.php?date=040616](http://www.cibus.com/press_release.php?date=040616)
- 31a= <https://www.pioneer.com/home/site/about/news-media/news-releases/template.CONTENT/guid.95ED9999-5719-1E79-8DA3-CE9A62C58CA2>
- 32a= <http://www.innatepotatoes.com/newsroom/view-news/usda-deregulates-additional-varieties-of-innate-second-generation-potatoes>
- 33a= <https://www.federalregister.gov/documents/2016/09/23/2016-22928/jr-simplot-company-availability-of-preliminary-finding-of-no-significant-impact-preliminary-plant>
- 34a= <http://www.cbc.ca/news/canada/prince-edward-island/potato-gmo-farmers-food-crops-1.3504446>
- 35a= [http://www.capitalpress.com/Nation\\_World/Nation/20161025/usda-clears-new-gmo-potato-variety](http://www.capitalpress.com/Nation_World/Nation/20161025/usda-clears-new-gmo-potato-variety)
- 36a= [https://www.aphis.usda.gov/biotechnology/downloads/reg\\_loi/aphis\\_response\\_collectis\\_potato.pdf](https://www.aphis.usda.gov/biotechnology/downloads/reg_loi/aphis_response_collectis_potato.pdf)
- 37a= [http://www.vib.be/en/about-vib/plant-biotech-news/Documents/BackgroundReport\\_Potato\\_ENG.pdf](http://www.vib.be/en/about-vib/plant-biotech-news/Documents/BackgroundReport_Potato_ENG.pdf)
- 38a= <http://www.tsl.ac.uk/news/new-potato-at-the-sainsbury-laboratory/>
- 39a= <http://www.collectis.com/en/content/collectis-plant-sciences-reports-generation-high-oleic-soybean-journal-plant-biotechnology-0>
- 40a= [https://one.oecd.org/document/ENV/JM/MONO\(2016\)5/en/pdf](https://one.oecd.org/document/ENV/JM/MONO(2016)5/en/pdf)
- 41a= <http://onlinelibrary.wiley.com/doi/10.1111/pbi.12444/full>
- 42a= [https://www.aphis.usda.gov/biotechnology/downloads/reg\\_loi/15-071-01air\\_resp.pdf](https://www.aphis.usda.gov/biotechnology/downloads/reg_loi/15-071-01air_resp.pdf)
- 43a= <http://www.calyxt.com/wp-content/uploads/2016/11/11-15-16-U.S.-Soybean-Product.pdf>
- 44a= <http://bmcplantbiol.biomedcentral.com/articles/10.1186/s12870-016-0906-1>
- 45a= <http://www.producer.com/2016/03/field-trials-on-non-gm-tolerant-flax-coming-soon/>
- 46a= [http://s21.q4cdn.com/813101928/files/doc\\_factsheets/agriculture/Agriculture-Fact-Sheet\\_10.6.pdf](http://s21.q4cdn.com/813101928/files/doc_factsheets/agriculture/Agriculture-Fact-Sheet_10.6.pdf)
- 47a= [https://www.cibus.com/pdfs/2017\\_Seed\\_Variety\\_Guide-Jim-Radtke.pdf](https://www.cibus.com/pdfs/2017_Seed_Variety_Guide-Jim-Radtke.pdf)

- 48a= <https://biovox.eu/insights/detail/dupont-pioneer-rsquo-s-next-generation-of-waxy-corn-shows-the-green-side-of-crispr-cas9>
- 49a= <https://www.technologyreview.com/s/609230/these-are-not-your-fathers-gmos/>
- 50a= <http://ir.yield10bio.com/releasedetail.cfm?ReleaseID=1039116>
- 51a= [https://www.aphis.usda.gov/biotechnology/downloads/reg\\_loi/17-166-01\\_air\\_response\\_signed.pdf](https://www.aphis.usda.gov/biotechnology/downloads/reg_loi/17-166-01_air_response_signed.pdf)
- 52a= <http://www.calyxt.com/products/>
- 53a= [https://www.aphis.usda.gov/biotechnology/downloads/reg\\_loi/17-038-02\\_air\\_response\\_signed.pdf](https://www.aphis.usda.gov/biotechnology/downloads/reg_loi/17-038-02_air_response_signed.pdf)
- 54a= [https://www.aphis.usda.gov/biotechnology/downloads/reg\\_loi/17-219-01\\_air\\_response\\_signed.pdf](https://www.aphis.usda.gov/biotechnology/downloads/reg_loi/17-219-01_air_response_signed.pdf)
- 55a= <http://www.calyxt.com/calyxt-and-farmers-business-network-inc-partner-to-expand-grower-base-for-calyxts-identity-preserved-high-oleic-soybeans/>
- 56a= <http://www.calyxt.com/calyxt-and-sws-gene-edited-alfalfa-plant-designated-as-non-regulated-by-usda/>
- 57a= [http://www.calyxt.com/wp-content/uploads/2017/11/Calyxt-Investor-Presentation\\_November-2017.pdf](http://www.calyxt.com/wp-content/uploads/2017/11/Calyxt-Investor-Presentation_November-2017.pdf)
- 58a= <http://www.bintjeplus.be/NL/HOME/tabid/7339/Default.aspx>
- 59a= <https://www.scientificamerican.com/article/genetically-modified-browning-resistant-apple-reaches-u-s-stores/>
- 60a= <https://agrow.agribusinessintelligence.informa.com/AG013374/BASFCibus-Clearfield-crops-advance>

## Tabelle 2: Neue GV-Pflanzen in der Forschungs- und Entwicklungspipeline

(UPDATE Stand: Dezember 2017, Neue Einträge sind unterstrichen)

→ Produkte, deren Kommerzialisierung wahrscheinlich ist, sind in der ersten Spalte grau hinterlegt

Kultur	Pflanze	Verfahren <sup>a)</sup>	Eigenschaften	Unternehmen <sup>b)</sup>	Entwicklungs- status <sup>c), d)</sup>	Freisetzungs- versuche	Quelle
<u>Raps</u>		TALEN	Herbizidresistenz	<i>Calyxt inc.</i> (USA)	Forschung & Entwicklung	nein	52b
Mais		RNAi	Trockenheitstoleranz	DuPont Pioneer (USA)	Forschung & Entwicklung	Chile, USA	1b
Mais		CRISPR	Trockenheitstoleranz	Du Pont Pioneer (USA)	Forschung & Entwicklung	Ja, USA	8b
Mais		Meganuklease- Technik	Veränderte Stärkezusammen- setzung	<i>Agrivida Inc.</i> (USA)	Forschung & Entwicklung	unklar	23b, 24b
<u>Mais</u>		CRISPR	Resistenz gegen <i>Maize Lethal Necrosis Disease</i>	DuPont Pioneer (USA), CIMMYT (Mexiko)	Forschung & Entwicklung Maissorten sollen für afrikanische Kleinbauern entwickelt werden	unklar	53b
Kartoffel		Cisgenese	Kraut- und Knollenfäuleresistenz	<i>Universität Wageningen</i> (NL)	Forschung & Entwicklung Es ist derzeit unklar, ob Projekt weitergeführt wird (keine Finanzierung)	NL, CH, Irland, Belgien	1b, 32b

Kultur	Pflanze	Verfahren <sup>a)</sup>	Eigenschaften	Unternehmen <sup>b)</sup>	Entwicklungsstatus <sup>c), d)</sup>	Freisetzungsversuche	Quelle
Kartoffel		Cisgenese	Kraut- und Knollenfäuleresistenz	<i>Biotechnology and Biological Sciences Research Council (BBSRC)</i> (UK)	Forschung (unklar ob Entwicklung)	Freisetzungsversuche (UK), 2010 - 2012	1b
<u>Kartoffel</u>		TALEN	Kraut- und Knollenfäule-Resistenz	<b>Calyxt Inc.</b> (USA)	Forschung & Entwicklung	nein	52b
<u>Kartoffel</u>		TALEN	Verbesserte Lagerfähigkeit bei kühlen Temperaturen & <i>non-browning</i>	<b>Calyxt Inc.</b> (USA)	Forschung & Entwicklung	nein	52b
<u>Soja</u>		TALEN	Verbesserte Protein-Zusammensetzung	<b>Calyxt Inc.</b> (USA)	Forschung & Entwicklung	nein	52b
<u>Soja</u>		TALEN	Trockentoleranz	<b>Calyxt Inc.</b> (USA)	Forschung & Entwicklung	nein	52b
<u>Soja</u>		TALEN	Erhöhter Ertrag	<b>Calyxt Inc.</b> (USA)	Forschung & Entwicklung	nein	52b
<u>Soja</u>		TALEN	Herbizidresistenz	<b>Calyxt Inc.</b> (USA)	Forschung & Entwicklung	nein	52b
<u>Weizen</u>		TALEN	Herbizidresistenz	<b>Calyxt Inc.</b> (USA)	Forschung & Entwicklung	nein	52b
Weizen		TALEN	Reduzierter Glutengehalt	<b>Calyxt Inc.</b> (USA)	Forschung & Entwicklung	nein	30b, <u>52b</u>
<u>Weizen</u>		TALEN	Erhöhter Ballaststoffgehalt	<b>Calyxt Inc.</b> (USA)	Forschung & Entwicklung (Phase I der Entwicklung abgeschlossen)	nein	50b
<u>Weizen</u>		TALEN	Erhöhter Ballaststoffgehalt	<b>Calyxt Inc.</b> (USA)	Forschung & Entwicklung	nein	52b

Kultur	Pflanze	Verfahren <sup>a)</sup>	Eigenschaften	Unternehmen <sup>b)</sup>	Entwicklungsstatus <sup>c), d)</sup>	Freisetzungsversuche	Quelle
Weizen		TALEN	Herbizidresistenz	<i>Calyxt Inc.</i> (USA)	Forschung & Entwicklung	nein	51b, 52b
Weizen		CRISPR	Gluten“freier“ Weizen	<i>Institute for Sustainable Agriculture in Cordoba (ES)</i>	Forschung & Entwicklung	nein	54b
Gerste		Cisgenese	Verbesserte Phytase-Aktivität	<i>Aarhus Universität</i> (DK)	Forschung (unklar ob Entwicklung)	Dänemark, 2012 - 2016	1b
Gerste		CRISPR	Pilzresistenz (u. a. Mehltau)	<i>Institut für Phytopathologie, Universität Giessen, Cerealpath-Forschungsverbund</i> (D)	Forschung (unklar ob Entwicklung)	unklar	40b, 41b, 42b
Reis		TALEN	Resistenz gegen eine bakterielle Krankheit	<i>State University of Iowa, Prof. Bing Yang</i> (USA)	APHIS-Bescheid 2015, Forschung	Sommer 2014, Universitäts-gelände, Iowa	25b, 26b
Grüne Borstenhirse ( <i>Setaria viridis</i> )		CRISPR	Blühverfrühung	<b>Donald Danforth Plant Science Center</b> (USA)	APHIS-Bescheid 2017, Forschung <sup>c)</sup>	unklar	48b, 49b
Alfalfa		Intragenese	Niedriger Ligningehalt	<i>J. R. Simplot</i> (USA)	Forschung & Entwicklung	unklar	1b
Alfalfa		TALEN	Herbizidresistenz	<i>Calyxt inc.</i> (USA)	Forschung & Entwicklung	nein	52b
Apfel, Birne		Pfropfen auf GV-Unterlage	Veränderte Wurzeleigenschaften, Einfluss der GV-Unterlage auf Wachstum, Blüte etc.	<i>Swedish University of Agricultural Sciences</i> (Schweden)	Forschung (unklar ob Entwicklung)	Schweden, 2015 - 2019	1b, 15b, 34b

Kultur	Pflanze	Verfahren <sup>a)</sup>	Eigenschaften	Unternehmen <sup>b)</sup>	Entwicklungsstatus <sup>c), d)</sup>	Freisetzungsversuche	Quelle
Apfel		Cisgenese	Erhöhter Anthocyan-Gehalt	<i>Stichting Dienst Landbouwkundig Onderzoek (DLO), Stichting Dienst Landbouwkundig Onderzoek (DLO) in particular Praktijkonderzoek Plant, Omgeving / Plant Research International (PPO/PR)</i> (NL)	Forschung (unklar ob Entwicklung)	NL, 2016 - 2026	1b, 11b, 33b
Apfel		Cisgenese	Feuerbrandresistenz	<i>ETH Zürich</i> (CH), <i>Agroscope</i> (CH)	Forschung <sup>d)</sup>	Mit Auflagen in CH bewilligt 2016 - 2019	1b, 12b
Apfel		Cisgenese	Schorfresistenz	<i>ETH Zürich</i> (CH), <i>Universität Wageningen</i> (NL)	Forschung (unklar ob Entwicklung), teilweise Regulierung, USDA 2012 (siehe Quelle 47b)	NL, Umfang unbekannt	1b, 47b
Apfel, Birne		unbekannt	Feuerbrandresistenz	<i>Okanagan Speciality Fruits</i> (seit 2015 zu <b>Intrexon</b> ) (USA)	Forschung & Entwicklung	unklar	27b
Apfel		unbekannt	Schorfresistenz	<i>Okanagan Speciality Fruits</i> (seit 2015 zu <b>Intrexon</b> ) (USA)	Forschung & Entwicklung	unklar	27b
Pflaume, Aprikose		Pfropfen auf GV-Unterlage	u.a. Trockenheitstoleranz	<i>Centro de Edafología y Biología del Segura</i> (E)	Forschung (unklar ob Entwicklung)	Spanien, 2015 - 2018	1b, 16b, 35b
Pfirsich		unbekannt	Resistenz gegen <i>Plum pox virus</i>	<i>Okanagan Speciality Fruits</i> (seit 2015 zu <b>Intrexon</b> ) (USA)	Forschung & Entwicklung	unklar	27b

Kultur	Pflanze	Verfahren <sup>a)</sup>	Eigenschaften	Unternehmen <sup>b)</sup>	Entwicklungsstatus <sup>c), d)</sup>	Freisetzungsversuche	Quelle
Walnuss		Pfropfen auf GV-Unterlage	Resistenz gegen <i>Crown Gall disease</i>	<i>Department of Pomology, University of California (USA)</i>	Forschung und Entwicklung, gemäss OECD-Workshop (2): „Close to commercialization“	unklar	43b, 2b
Erdbeere		Cisgenese	Ertragssteigerung, verbessertes Shelf life, erhöhter Zuckergehalt, Krankheitsresistenz	<i>J. R. Simplot (USA)</i>	Forschung & Entwicklung	Ja, ab 2015	38b, 39b
Weinrebe		Intragenese	Erhöhter Anthocyan-Gehalt	<i>University of Florida (USA)</i>	Keine Regulierung, USDA-Bescheid 2012	unklar	1b, 44b, 46b
Weinrebe		Pfropfen auf GV-Unterlage	Resistenz gegen die bakterielle <i>Pierce disease</i>	<i>Department of Viticulture and Enology, University of California (USA)</i>	Forschung & Entwicklung, gemäss OECD-Workshop (2): „Product development for commercialization“	unklar	2b,45b
Weinrebe		Pfropfen auf GV-Unterlage	Resistenz gegen Reisigkrankheit	<i>French National Institute for Agricultural Research (INRA) (FRA)</i>	Forschung (unklar ob Entwicklung)	ab 2010, Dauer unbekannt	44b
Bäume		RNAi	Veränderte Lignin-Zusammensetzung	unbekannt (Belgien)	Forschung (unklar ob Entwicklung)	Belgien	2b
Pappel		CRISPR Transgenese	Grundlagenforschung	<i>Umeå University, Department of Plant Physiology (Schweden)</i>	Forschung <sup>d)</sup>	2016 – 2021, Schweden	31b



Kultur	Pflanze	Verfahren <sup>a)</sup>	Eigenschaften	Unternehmen <sup>b)</sup>	Entwicklungsstatus <sup>c), d)</sup>	Freisetzungsversuche	Quelle
	Acker-Schmalwand (Arabidopsis thaliana)	CRISPR	Protein PsbS („Sicherheitsventil“ in der Photosynthese) wurde ausgeschaltet	<i>Umeå Plant Science Centre and Umeå University</i> (Schweden)	Forschung <sup>d)</sup>	Ab Sommer 2016, Schweden	19b, 20b

**Anmerkungen:**

a) Verfahren – zur besseren Unterscheidbarkeit farbig markiert: ODM = Oligonukleotid-gerichtete Mutagenese / CRISPR = Clustered Regularly Interspaced Short Palindromic Repeats / ZFN = Zinkfinger-Nuklease-Verfahren / TALEN = Transcription activator-like effector nuclease / Intragenese / Cisgenese / RNAi = RNA-Interferenz / Pfropfen auf GV-Unterlage

b) Unternehmen (kursiv) = Entwickler der Technologie; Unternehmen (fett) = Anwender; (kursiv und fett) = Unternehmen & Entwickler

c) Forschung & Entwicklung = angewandte Forschung (→ Kommerzialisierung wird wahrscheinlich angestrebt)

d) Reine Forschungsprojekte sind in dieser Tabelle nur aufgeführt, wenn, sofern bekannt, Freisetzungsversuche damit verbunden sind.

## Quellen

1b= Ricroch, A. E., Hénard-Damave, M.-C. 2015: Next biotech plants: new traits, crops, developers and technologies for addressing global challenges. In: Critical Reviews in Biotechnology. Published online: 2 February 2015, ISSN; 1549-7801. Download unter:

[www.ncbi.nlm.nih.gov/pubmed/25641327](http://www.ncbi.nlm.nih.gov/pubmed/25641327)

2b= Report of the OECD Workshop on Environmental Risk Assessment of products derived from New Plant Breeding Techniques (February 2014). Download unter: [https://one.oecd.org/document/ENV/JM/MONO\(2016\)5/en/pdf](https://one.oecd.org/document/ENV/JM/MONO(2016)5/en/pdf)

3b= [www.testbiotech.org/node/1433](http://www.testbiotech.org/node/1433)

4b= [www.producer.com/2016/01/herbicide-tolerant-flax-project-progressing/](http://www.producer.com/2016/01/herbicide-tolerant-flax-project-progressing/)

5b= [www.nytimes.com/2015/11/15/magazine/the-crispr-quandary.html?\\_r=0](http://www.nytimes.com/2015/11/15/magazine/the-crispr-quandary.html?_r=0)

6b= [www.technologyreview.com/s/542311/dupont-predicts-crispr-plants-on-dinner-plates-in-five-years/](http://www.technologyreview.com/s/542311/dupont-predicts-crispr-plants-on-dinner-plates-in-five-years/)

7b= [www.transgen.de/lebensmittel/1475.kartoffeln-aepfel-usa-gentechnik.html](http://www.transgen.de/lebensmittel/1475.kartoffeln-aepfel-usa-gentechnik.html)

8b= <https://www.pioneer.com/home/site/about/news-media/news-releases/template.CONTENT/guid.95ED9999-5719-1E79-8DA3-CE9A62C58CA2>

9b= [www.isaaa.org/gmapprovaldatabase/event/default.asp?EventID=177](http://www.isaaa.org/gmapprovaldatabase/event/default.asp?EventID=177)

10b= [www.vistivegold.com/](http://www.vistivegold.com/)

11b= [gmoinfo.jrc.ec.europa.eu/gmp\\_report.aspx?CurNot=B/NL/15/L01](http://gmoinfo.jrc.ec.europa.eu/gmp_report.aspx?CurNot=B/NL/15/L01)

12b= [www.agroscope.admin.ch/aktuell/00198/05299/05494/index.html?lang=de&msg-id=59229](http://www.agroscope.admin.ch/aktuell/00198/05299/05494/index.html?lang=de&msg-id=59229)

13b= [www.ars.usda.gov/is/br/plumpox/](http://www.ars.usda.gov/is/br/plumpox/)

- 14b= [www.miljodirektoratet.no/Global/dokumenter/Publikasjoner/Rapporter/Biosafety\\_Report\\_2013\\_01\\_Gen%C3%98k%20t%C3%B8rr%C3%A5te.pdf](http://www.miljodirektoratet.no/Global/dokumenter/Publikasjoner/Rapporter/Biosafety_Report_2013_01_Gen%C3%98k%20t%C3%B8rr%C3%A5te.pdf)
- 15b= [gmoinfo.jrc.ec.europa.eu/gmp\\_report.aspx?CurNot=B/SE/14/13820](http://gmoinfo.jrc.ec.europa.eu/gmp_report.aspx?CurNot=B/SE/14/13820)
- 16b= [gmoinfo.jrc.ec.europa.eu/gmp\\_report.aspx?CurNot=B/ES/15/01](http://gmoinfo.jrc.ec.europa.eu/gmp_report.aspx?CurNot=B/ES/15/01)
- 17b= [www.genewatch.org](http://www.genewatch.org)
- 18b= [www.morflora.com/?cp=584](http://www.morflora.com/?cp=584)
- 19b= <http://www.umu.se/ViewPage.action?siteNodeId=4510&languageId=1&contentId=259265>
- 20b= [https://www.buzzfeed.com/stephaniemlee/new-gmos-in-europe?utm\\_term=.gdG6ranDQ#.el6YpIL62](https://www.buzzfeed.com/stephaniemlee/new-gmos-in-europe?utm_term=.gdG6ranDQ#.el6YpIL62)
- 21b= [https://www.aphis.usda.gov/biotechnology/downloads/reg\\_loi/15-238-01\\_air\\_inquiry\\_cbidel.pdf](https://www.aphis.usda.gov/biotechnology/downloads/reg_loi/15-238-01_air_inquiry_cbidel.pdf)
- 22b= [https://www.aphis.usda.gov/biotechnology/downloads/reg\\_loi/15-238-01\\_air\\_response\\_signed.pdf](https://www.aphis.usda.gov/biotechnology/downloads/reg_loi/15-238-01_air_response_signed.pdf)
- 23b= [https://www.aphis.usda.gov/biotechnology/downloads/reg\\_loi/15-078-02\\_air\\_inquiry.pdf](https://www.aphis.usda.gov/biotechnology/downloads/reg_loi/15-078-02_air_inquiry.pdf)
- 24b= [https://www.aphis.usda.gov/biotechnology/downloads/reg\\_loi/15-078-02\\_air\\_response\\_final.pdf](https://www.aphis.usda.gov/biotechnology/downloads/reg_loi/15-078-02_air_response_final.pdf)
- 25b= [https://www.aphis.usda.gov/biotechnology/downloads/reg\\_loi/air\\_isu\\_ting\\_rice.pdf](https://www.aphis.usda.gov/biotechnology/downloads/reg_loi/air_isu_ting_rice.pdf)
- 26b= [https://www.aphis.usda.gov/biotechnology/downloads/reg\\_loi/aphis\\_resp\\_isu\\_ting\\_rice.pdf](https://www.aphis.usda.gov/biotechnology/downloads/reg_loi/aphis_resp_isu_ting_rice.pdf)
- 27b= <http://www.okspecialtyfruits.com/about-osf/future-products/>
- 28b= <http://www.delmontefoods.com/frequently-asked-questions#GMO>
- 29b= <http://www.calyxt.com/products/lower-saturated-fat-canola-oil/>
- 30b= <http://www.calyxt.com/products/gluten-reduced-wheat/>

- 31b= [http://gmoinfo.jrc.ec.europa.eu/gmp\\_report.aspx?CurNot=B/SE/16/3494](http://gmoinfo.jrc.ec.europa.eu/gmp_report.aspx?CurNot=B/SE/16/3494)
- 32b= <http://www.wur.nl/en/Expertise-Services/Research-Institutes/plant-research/DuRPh.htm>
- 33b= [http://gmoinfo.jrc.ec.europa.eu/gmp\\_report.aspx?CurNot=B/NL/15/L01](http://gmoinfo.jrc.ec.europa.eu/gmp_report.aspx?CurNot=B/NL/15/L01)
- 34b= [http://gmoinfo.jrc.ec.europa.eu/gmp\\_report.aspx?CurNot=B/SE/14/13820](http://gmoinfo.jrc.ec.europa.eu/gmp_report.aspx?CurNot=B/SE/14/13820)
- 35b= [http://gmoinfo.jrc.ec.europa.eu/gmp\\_report.aspx?CurNot=B/ES/15/01](http://gmoinfo.jrc.ec.europa.eu/gmp_report.aspx?CurNot=B/ES/15/01)
- 36b= [http://gmoinfo.jrc.ec.europa.eu/gmp\\_report.aspx?CurNot=B/ES/13/20](http://gmoinfo.jrc.ec.europa.eu/gmp_report.aspx?CurNot=B/ES/13/20)
- 37b= <http://www.nature.com/nbt/journal/v34/n4/full/nbt.3533.html>
- 38b= <http://www.transgen.de/aktuell/2565.freisetzung-gentechnik-usa-eu.html>
- 39b= [http://events.cornell.edu/event/how\\_simplot\\_plant\\_sciences\\_plans\\_to\\_make\\_and\\_commercialize\\_genetically\\_modified\\_strawberries](http://events.cornell.edu/event/how_simplot_plant_sciences_plans_to_make_and_commercialize_genetically_modified_strawberries)
- 40b= [http://www.deutschlandfunk.de/gentechnik-vom-umkaempften-freilandversuch-zur-crispr-gerste.697.de.html?dram:article\\_id=353030](http://www.deutschlandfunk.de/gentechnik-vom-umkaempften-freilandversuch-zur-crispr-gerste.697.de.html?dram:article_id=353030)
- 41b= <http://cerealpath.eu/about-cerealpath/research-areas/>
- 42b= <http://cerealpath.eu/who-is-involved/programme-partners/>
- 43b= <http://www.sciencedirect.com/science/article/pii/S0168945202001644>
- 44b= <http://link.springer.com/article/10.1007/s00299-016-1974-2>
- 45b= <https://www.ncbi.nlm.nih.gov/pubmed/20565637>
- 46b= [https://www.aphis.usda.gov/biotechnology/downloads/reg\\_loi/Grapevine\\_Inquiry\\_BR\\_response\\_042412.pdf](https://www.aphis.usda.gov/biotechnology/downloads/reg_loi/Grapevine_Inquiry_BR_response_042412.pdf)
- 47b= [https://www.aphis.usda.gov/biotechnology/downloads/reg\\_loi/aphis\\_response\\_schouten.pdf](https://www.aphis.usda.gov/biotechnology/downloads/reg_loi/aphis_response_schouten.pdf)
- 48b= [https://www.aphis.usda.gov/biotechnology/downloads/reg\\_loi/16-066-01\\_air\\_response\\_signed.pdf](https://www.aphis.usda.gov/biotechnology/downloads/reg_loi/16-066-01_air_response_signed.pdf)

49b= <https://www.technologyreview.com/s/609230/these-are-not-your-fathers-gmos/>

50b= <http://www.calyxt.com/products/high-fiber-wheat/>

51b= <http://www.calyxt.com/products/herbicide-tolerant-wheat/>

52b= [http://www.calyxt.com/wp-content/uploads/2017/11/Calyxt-Investor-Presentation\\_November-2017.pdf](http://www.calyxt.com/wp-content/uploads/2017/11/Calyxt-Investor-Presentation_November-2017.pdf)

53b= <http://crisprcas.pioneer.com/wp-content/uploads/2017/01/2016-09-28-PION-DuPont-CIMMYT-FINAL-2.pdf>

54b= <https://www.newscientist.com/article/2148596-genetically-modified-wheat-used-to-make-coeliac-friendly-bread/>

i „Cibus has developed several varieties with different events including 5715 used for Canadian regulatory applications. Event 5715 is actually a cross between this RTDS™ line and a pre-existing Clearfield Canola variety called Cougar CL, which already possessed a single-nucleotide mutation in a related AHAS gene on the A genome (BnAHAS3A), and the resulting hybrid demonstrates enhanced and consistent tolerance to imidazolinone and sulfonylurea herbicides (Health Canada (2013) Novel Food Information—Cibus Canola Event 5715 (Imidazolinone and Sulfonylurea Herbicide Tolerant) 26th Nov 2013. <http://www.hc-sc.gc.ca/fn-an/gmf-agm/appro/canola-5715-eng.php> (accessed 31 May 17)).” Jorge Martínez-Fortún, Dylan W. Phillips and Huw D. Jones 2017: Potential impact of genome editing in world agriculture. *Emerging Topics in Life Sciences* (2017) 1 117–133 <https://doi.org/10.1042/ETLS20170010>, (121).

## Lizenzvereinbarungen und Kooperationen

### zwischen Züchtungs- und Biotech-Unternehmen – Start-Ups – Forschungseinrichtungen/Universitäten

### im Bereich der neuen gentechnischen Verfahren (2005 – 2017)

(Stand: Dezember 2017, neue Einträge sind unterstrichen)

→ Die Einträge betreffend Landwirtschaft aus der [CRISPR Licenses Dataverse](#) (der *New York Law School*) sind in der Tabelle aufgenommen. Die Datensammlung enthält “*redacted and unreacted copies of IP license agreements in the CRISPR gene editing space, as well as press releases containing substantive information about confidential licenses.*”

Lizenzgeber	Lizenznehmer	Verfahren	Jahr-Monat	Verwendungszweck	Quelle
Broad Institute (USA)	Syngenta (China, CH)	CRISPR-Cas9	<u>2017-11</u>	“Syngenta announced (...) it has attained a non-exclusive IP license from the Broad Institute of MIT and Harvard for <b>CRISPR-Cas9 genome-editing technology for agricultural applications</b> . CRISPR-Cas9 genome editing technology complements Syngenta’s already robust plant breeding innovation toolbox. <b>Syngenta is applying this technology in multiple crops, including corn, wheat, tomato, rice and sunflower.</b> ”	48

<b>Lizenzgeber</b>	<b>Lizenznehmer</b>	<b>Verfahren</b>	<b>Jahr-Monat</b>	<b>Verwendungszweck</b>	<b>Quelle</b>
<p>Broad Institute (USA)</p> <p style="text-align: center;"><b>+</b></p> <p><i>to jointly provide <b>non-exclusive licenses to foundational CRISPR-Cas9 intellectual property under their respective control for use in commercial agricultural research and product development</b></i></p>	<p>DuPont Pioneer (USA)</p>	CRISPR-Cas9	<u>2017-10</u>	<p>“DuPont Pioneer and the Broad Institute of MIT and Harvard announced (...) that they have reached an agreement to <b>jointly provide non-exclusive licenses to foundational CRISPR-Cas9 intellectual property under their respective control for use in commercial agricultural research and product development.</b> These two major CRISPR-Cas9 license holders are coming together with the shared goal of enabling all entities wanting to apply the technology for agricultural applications with a full range of CRISPR-Cas9 tools. Such foundational intellectual property (IP) for CRISPR-Cas9 technology <b>will be freely available to universities and nonprofit organizations for academic research.</b> (...)”</p>	55
<p>Broad Institute (USA)</p>	<p>Arcadia Bioscience Inc. (USA)</p>	CRISPR-Cas9	<u>2017-09</u>	<p>“Arcadia Biosciences, Inc. (...), an agricultural technology company, announced (...) that it has signed a <b>global licensing agreement</b> with the Broad Institute of MIT and Harvard <b>for research use of the CRISPR- Cas9 genome-editing technology in agriculture.</b> The technology will enable Arcadia to accelerate the research and development of its agricultural nutrition and productivity traits.”</p>	51



<i>Lizenzgeber</i>	<i>Lizenznehmer</i>	<i>Verfahren</i>	<i>Jahr-Monat</i>	<i>Verwendungszweck</i>	<i>Quelle</i>
<i>ToolGen (USA)</i>	<i>Monsanto (USA)</i>	CRISPR-technology platform	<u>2017-08</u>	“Monsanto and ToolGen, a biotechnology company specializing in genome editing, have reached a <b>global licensing agreement for the use of ToolGen’s CRISPR technology platform to develop agricultural products</b> . ToolGen is an early pioneer in gene editing research. The license provides Monsanto with access to ToolGen’s comprehensive suite of CRISPR intellectual property for use in plants. This agreement further expands Monsanto’s broad portfolio of gene-editing tools that can be used to develop improved and sustainable crops.”	54
<i>DuPont Pioneer (USA)</i>	<i>ERS Genomics</i>	CRISPR-Cas	<u>2017-06</u>	“DuPont Pioneer (DuPont) and ERS Genomics (ERS) announced a <b>technology license agreement</b> whereby <b>DuPont gains exclusive rights to the ERS patent portfolio covering CRISPR-Cas genome editing technology for all agricultural uses and applications in plants. (...) Pioneer is applying CRISPR-Cas as an advanced plant breeding tool to develop seed products for greater environmental resiliency, productivity and sustainability</b> . Pioneer has defined CRISPR-Cas guiding principles, which include helping enable others wanting to develop agricultural products using CRISPR-Cas by providing access to its IP, technology capabilities, infrastructure and scientific expertise.”	53

<b>Lizenzgeber</b>	<b>Lizenznehmer</b>	<b>Verfahren</b>	<b>Jahr-Monat</b>	<b>Verwendungszweck</b>	<b>Quelle</b>
<i>Broad Institute (USA)</i>	<i>BASF (Germany)</i>	CRISPR-Cas9	<u>2017-03</u>	“BASF (...) announced that it has reached a <b>global licensing agreement</b> with the Broad Institute of MIT and Harvard for the <b>use of CRISPR-Cas9 genome-editing technology to improve products in agricultural and industrial microbiology applications.</b> ”	47
<i>Broad Institute (USA)</i>	<i>Monsanto (USA)</i>	CRISPR-Cpf1	<u>2017-03</u>	“Monsanto Company announced that it has reached a new <b>global licensing agreement</b> with the Broad Institute of MIT and Harvard for the <b>use of the novel CRISPR-Cpf1 genome-editing technology in agriculture.</b> The CRISPR-Cpf1 system represents an exciting advance in genome-editing technology, because it has potential to be a simpler and more precise tool for making targeted improvements in a cell’s DNA when compared to the CRISPR-Cas9 system.”	52
<i>Two Blades Foundation (2Blades) (USA)</i>	<i>International Rice Research Institute (IRRI) (Philippines)</i>	TALEN	<u>2016-12</u>	“2Blades and the International Rice Research Institute (IRRI) have signed an agreement to further the cause of global food and nutrition security for the 3.5 billion people who depend on rice for more than 20% of their daily calories. The innovative <b>licensing agreement will enable IRRI to access leading-edge gene-editing technology, known as Transcription Activator Like (TAL) Effector Code and apply it to targets in rice genomes to increase micronutrient content in polished rice, particularly iron and zinc.</b> (...) Access to the TAL Code technology will enable IRRI to accelerate its on-going research into high-iron/ high-zinc rice varieties and actively advance viable, rice sector-based solutions to global food and nutrition security issues, including	49

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				making improved rice varieties available more quickly to smallholder rice farmers. The agreement will positively impact a number of advanced breeding projects currently underway at IRRI.”	
<i>Dow AgroSciences LLC (USA)</i>	<i>Department of Environment and Primary Industries (DEPI) via Agriculture Victoria Services Pty Ltd. (Australia)</i>	EXZACT™ Precision Technology Platform (ZFN)	2016-12	“Dow AgroSciences announced that Agriculture Victoria's commercial arm, Agriculture Victoria Services Pty Ltd. ("AVS") is taking a commercial license to the EXZACT Precision Technology Platform to continue the development and commercialization of new forage grass varieties to benefit growers in Australia and around the world. <b>The commercial license agreement aims at the development of forage grass varieties and related fungal endophytes produced using precision genome editing technologies.</b> The license agreement acknowledges the advances Agriculture Victoria has made researching and developing innovative forage products using this gene editing platform that Dow AgroSciences has developed under an exclusive license and collaboration deal in plants with Sangamo BioSciences, Inc.”	46
<i>Dow AgroSciences LLC (USA)</i>	<i>Monsanto Company (USA)</i>	EXZACT™ Precision Technology Platform (ZFN)	2016-10	“For <b>research and commercial development of new crop solutions</b> across Monsanto Company's research portfolio.”	2
<i>DuPont Pioneer (USA)</i>	<i>International Maize &amp; Wheat Improvement Center/CIMMYT (Mexico)</i>	CRISPR-Cas	2016-09	“This collaboration with DuPont Pioneer will allow us <b>to provide climate and disease resilient varieties</b> more quickly to smallholder farmers in the developing world.” (CIMMYT Director General Martin Kropff)	3

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Broad Institute (USA)	Monsanto Company (USA)	CRISPR-Cas	2016-09	“The Broad Institute has decided to make available non-exclusive research and commercial licenses for the <b>use of CRISPR technology in agriculture. But with important restrictions.</b> These include: Gene Drive, Sterile Seeds, Tobacco.”	4, 7
TargetGene Biotechnologies LTD (Israel)	Monsanto Company (USA) ← Beteiligung an	RNA-guided gene-editing techniques	2016-06	“Under the agreement, Monsanto has been granted an exclusive license to TargetGene’s novel and proprietary “T-GEE” (Genome Editing Engine) platform <b>to deliver continuous improvements in agriculture.</b> Monsanto has also established an equity position in the private Israel-based company.“	5
Nomad Bioscience GmbH (D)	Monsanto Company (USA)	Gene Editing	2016-06	“... have announced a licensing agreement whereby Monsanto has obtained rights to apply Nomad’s proprietary technology to its genome-editing projects <b>aimed at enhancement of agricultural crops.</b> The licensed technology enables more efficient development of edited traits and may be applied across a broad range of genome-editing technologies and project types.”	6

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Caribou Bioscience (USA)	Genus (USA)	CRISPR-Cas9- technology platform	<u>2016-05</u>	“Genus plc (...), a global pioneer in animal genetics, and Caribou Biosciences, Inc. (...), are pleased to announce a <b>multi-year strategic collaboration</b> where <b>Genus receives a worldwide, exclusive license to Caribou’s leading CRISPR-Cas9 gene editing technology platform in certain livestock species.</b> (...) The agreement gives Genus exclusive access to Caribou’s CRISPR-Cas9 technology <b>for the development of new traits in pigs, cattle and potentially other livestock species.</b> In addition to an upfront payment, Caribou is eligible to receive regulatory and commercial milestone payments as well as royalties on licensed product sales from Genus. Additional terms of the agreement were not disclosed.”	56
<i>Institute of Genetics and Developmental Biology (IGDB), Chinese Academy of Sciences (China)</i> via <i>Plant Bioscience Limited (PBL) (UK)</i>	<i>Calyxt, Inc. (USA)</i>	TALEN	2015-12	“... signed a research collaboration and option to exclusive licenses with Plant Bioscience Limited (PBL) <b>for certain new crop plants developed using gene editing</b> by the Institute of Genetics and Developmental Biology (IGDB) of the Chinese Academy of Sciences in Beijing. <i>Plants with new traits in wheat, rice and corn are currently at various stages of development using gene-editing technology and include quality improvement and yield increase traits.</i> ”	10

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Arcadia Biosciences, Inc. (USA)	Dow AgroSciences LLC (USA)	EXZACT™ Precision Technology Platform (ZFN)	2015-12	„Arcadia Biosciences, Inc. (...) and Dow AgroSciences LLC (...) announce a strategic collaboration <b>to develop and commercialize new breakthrough yield traits and trait stacks in corn</b> . The collaboration leverages Arcadia’s leading platform of abiotic stress traits with Dow AgroSciences’ enabling technology platforms, input traits, regulatory capabilities and commercial channels. (...) The collaboration will also utilize Dow AgroSciences’ EXZACT™ Precision Technology Platform <b>to enhance and accelerate the development of trait stacks</b> . Dow AgroSciences has developed the EXZACT™ Precision Technology Platform under an exclusive license and collaboration agreement in plants with Sangamo BioSciences, Inc.“	17
Caribou BioSciences Inc. (USA)	DuPont Pioneer (USA)  ⇔ Kreuzlizenzierung	CRISPR-Cas	2015-10	“DuPont and Caribou have <b>cross-licensed their respective patent portfolios</b> , with DuPont receiving exclusive intellectual property rights for CRISPR-Cas <b>technology applications in major row crops</b> , and non-exclusive rights in <b>other agricultural and industrial bioscience applications</b> . ... the alliance between DuPont and Caribou involves a multi-year <b>research collaboration</b> with scientists from the two organizations focused on <b>enhancing the breadth, versatility and efficiency of the core CRISPR-Cas toolkit</b> . DuPont also has made a minority equity investment in Caribou to further strengthen the working relationship.”	9

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Dow AgroSciences (USA)	Institute of Crop Sciences, Chinese Academy of Agricultural Sciences (ICS-CAAS) (China)	EXZACT™ Precision Technology platform (ZFN)	2015-08	“Dow AgroSciences LLC (...) has entered into a collaboration agreement with the Institute of Crop Sciences of the Chinese Academy of Agricultural Sciences (ICS-CAAS). Under the agreement, Dow AgroSciences grants ICS-CAAS a royalty-free, non-transferable research and commercialization license for its proprietary <b>EXZACT™ Precision Genome Editing Technology to be used in rice in China</b> . Dow AgroSciences and ICS-CAAS scientists <b>will collaboratively develop an industry-leading rice genome editing technology platform.</b> ”	34
Vilnius University, Institute of Biotechnology (Lithuania)	DuPont Pioneer (USA)	CRISPR-Cas9	2015-06	“... announced a technology license and <b>research collaboration agreement</b> with Vilnius University <b>to further the technical and commercial utility of guided Cas9 genome editing technology</b> . Under the agreement, DuPont receives an exclusive license to Vilnius University intellectual property <i>for all commercial uses, including in agriculture.</i> ”	8

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Dow AgroSciences (USA)	Department of Environment and Primary Industries (DEPI) via Agriculture Victoria Services Pty Ltd. (Australia)	EXZACT™ Precision Technology platform (ZFN)	2015-05	„The Department of Environment and Primary Industries (DEPI) of the State of Victoria, Australia, through its commercial arm, Agriculture Victoria Services Pty Ltd. (AVS), strengthened a <b>collaborative agreement to improve the performances of Australian canola varieties</b> . The project uses the EXZACT™ Precision Genome Editing Technology platform <b>to continue developing new varieties of canola with enhanced performance</b> designed to benefit farmers in Australia and globally. In addition, AVS will also use the EXZACT™ Precision Genome Editing Technology platform <b>to enhance the genetics of crops important to Australian primary producers.</b> “	40
University of Minnesota (USA)	Cellectis plant sciences, Inc. (FRA)	CRISPR-Cas	2015-04	“Cellectis has signed an exclusive license agreement with the University of Minnesota that grants Cellectis the worldwide rights <b>to use the technology covered by the patent rights of the family WO/2014/144155 entitled “Engineering Plant Genomes Using CRISPR/Cas Systems”.</b> ”	14
Dow AgroSciences (USA)	Chinese Academy of Agricultural Sciences (CAAS) (China)	EXZACT™ Precision Technology platform (ZFN)	2015-03	“CAAS will negotiate a license to Dow AgroSciences’ proprietary EXZACT™ Precision Technology platform and toolkit and collaboratively develop a proposed <b>research program with mutual development goals</b> . Dow AgroSciences and CAAS scientists will also work together to make sure that Dow AgroSciences’ expertise is best combined with CAAS’ expertise <b>to accelerate rice research and product development in China.</b> ”	15



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Two Blades Foundation (2Blades) (USA)	Cellectis plant sciences, Inc. (FRA)	TAL Nuclease Technologies (TALEN)	2014-12	“...announced the execution of a non-exclusive cross-license agreement relating to TAL nuclease technologies. Pursuant to the agreement, 2Blades receives a license to TALEN™ technology <b>for not-for-profit uses</b> , including use in 2Blades’ <b>humanitarian efforts to support subsistence farming</b> , and for certain <b>commercial applications related to the disease resistance programs</b> of 2Blades. In addition (...) Cellectis plant sciences receives a license under 2Blades’ TAL Code technology related to nucleases <b>for commercial uses in certain specified crop plants</b> . Cellectis plant sciences has an option <b>to expand its license to additional crops</b> .”	28
	⇔ Kreuzlizenzierung				

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Dow AgroSciences (USA)	Department of Environment and Primary Industries (DEPI) of the State of Victoria (Australia)	EXZACT™ Precision Technology platform (ZFN)	<u>2014-08</u>	<p>“Dow AgroSciences (...) and the Department of Environment and Primary Industries (DEPI) of the State of Victoria, announced today several significant steps the organizations are taking together to advance science for agriculture. Dow AgroSciences has worked with DEPI through its commercial arm - Agriculture Victoria Services Pty Ltd. (AVS) - to apply the company’s EXZACT™ Precision Technology Platform to improve the performance of canola varieties and is adding a new project. Collaborators since 2009, the organizations are now planning to enter into a seventh project together. The project builds on previous work from the collaboration, and is using the EXZACT™ Precision Genome Editing Technology Platform to continue developing new varieties of canola with enhanced performance designed to benefit farmers in Australia and around the world. This new research project will be based at DEPI’s AgriBio research facilities in Bundoora. In addition, AVS has entered into a major <b>Research License Agreement with Dow AgroSciences to conduct research using the company’s proprietary EXZACT Precision Genome Editing Technology Platform to enhance the genetics of crops of importance to Australian primary producers.</b>”</p>	50

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Dow AgroSciences (USA)	Sigma-Aldrich Corporation (USA)	Zinc finger nuclease (ZFN) reagents for use with EXZACT™ Precision Technology	2014-05	“Dow AgroSciences LLC (...) and Sigma-Aldrich Corporation (...) announced (...) an exclusive manufacturing license and supply agreement that will allow Sigma-Aldrich to manufacture and supply zinc finger nuclease (ZFN) reagents for use with EXZACT™ Precision Technology. Under the terms of the agreement, <b>Sigma-Aldrich will be the exclusive provider of ZFN reagents for use in plants which will be available to Dow AgroSciences, its affiliates and licensees</b> of the EXZACT Precision Technology <b>to enable precision transformation, trait stacking and targeted mutagenesis in plants.</b> ”	19
Precision BioSciences (USA)	Danziger Innovations Ltd. (USA)	Precision’s Directed Nuclease Editor (DNE) gene editing technology	2014-03	„Danziger Innovations Ltd. and Precision BioSciences, Inc., (...) announced that they <b>have successfully generated site-specific genome modifications in petunia and jasmine tobacco</b> by combining Precision’s Directed Nuclease Editor (DNE) gene editing technology with Danziger’s MemoGene gene delivery system. This successful research effort was aimed at genetic control of flower color but researchers at Precision and Danziger believe that the approach can be used more broadly to address genome engineering challenges in plants that are recalcitrant to existing transformation methods without requiring the insertion of foreign DNA into the plant genome.“	32

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Precision BioSciences (USA)	Agrivida (USA)	Directed Nuclease Editor™ (DNE) Technology	2014-03	“Precision BioSciences and Agrivida revealed today that they have entered into a <b>trait development collaboration</b> based on precise gene modifications made possible by Precision’s Directed Nuclease Editor™ (DNE) Technology. The collaboration recently delivered the first modified genes that are the subject of Agrivida <b>commercialization efforts in the area of animal nutrition.</b> ” ( <b>Corn Traits for Improved Dairy and Beef Nutrition</b> ).	11
Precision BioSciences, Inc. (USA)	Nova Synthetix (USA)	Precision’s Directed Nuclease Editor (DNE) technology	2014-03	„Nova Synthetix and Precision BioSciences, Inc., (...) announced that they have initiated a joint research effort <b>to generate non-GM, ricin-free castor plants</b> using Precision’s Directed Nuclease Editor (DNE) technology in combination with Nova Synthetix’s proprietary plant transformation system. Scientists at Nova Synthetix and Precision also plan to utilize their joint capabilities to generate <b>improved castor variants capable of producing user defined oil profiles</b> for industrial, biofuel, and feed-directed applications. The companies believe that the successful development of this multi-year research effort will address a significant agricultural need and result in a castor plant that is safer and has far greater market utility.“	31

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Cibus Global (USA)	Nucelis (will now become an independent operating unit of Cibus) (USA)	Rapid Trait Development System (RTDS)	2014-01	“Cibus Global (...) said it <b>has acquired Nucelis</b> , which is working in fermentation and bio-based chemicals, including alternative squalane and D2 products. Established in 2010, Nucelis will now become an independent operating unit of Cibus, which employs about 100 people worldwide, and also includes Cibus US LLC and Cibus Europe B.V. <b>Nucelis will continue to be the exclusive licensee to Cibus’ Rapid Trait Development System (RTDS) technology</b> in its key <b>product areas of fermentation and bio-based chemicals.</b> ”	37
Cellestis plant sciences (FRA)  ⇔	Precision BioSciences (USA) Kreuzlizenzierung	Meganuclease technology	2014-01	“Precision BioSciences, Inc. and Cellestis SA (...) announced that they have reached an agreement to settle patent litigation involving engineered I-CreI meganuclease technology. As part of the settlement, the companies will <b>cross-license certain genome engineering patents</b> and drop their ongoing lawsuits and patent challenges. This agreement provides clear freedom to operate for both companies in the engineered I-CreI meganuclease genome engineering field.”	30

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<i>Collectis plant sciences</i> (FRA)	<i>Bayer CropScience</i> (D)	Gene editing	2014-01	“Collectis plant sciences (...) has signed two new agreements with Bayer CropScience (...) in the areas of seeds, crop protection and non-agricultural pest control, on gene editing in plants. The agreements extend the companies’ existing partnership <b>to introduce targeted modifications to selected plant genes and genomes.</b> (...) The first aim of this extended partnership is to collaboratively <b>create commercial traits for the canola seed market</b> using new technologies developed by Collectis plant sciences. The second aim is to provide Bayer with access to technologies that enable the directed engineering of plant genomes, such as <b>gene stacking and targeted mutagenesis</b> , for the development of improved crops.”	18
<i>Two Blades Foundation (2Blades)</i> (USA)	<i>DuPont Pioneer</i> (USA)	TAL Effector Technology (TALEN)	2012-12	“2Blades continues broad license access to its award-winning TAL technology through a non-exclusive license to Dupont Pioneer <b>for uses in certain crops.</b> Improvements to the technology will be granted back for 2Blades’ humanitarian projects benefiting subsistence farming.”	22
<i>Iowa State University</i> (USA)	<i>Collectis plant sciences, Inc.</i> (FRA)	Inventions related to TAL effector-nucleases (TALENs™) and monomeric TALENs™	2012-10	“Collectis (...), the genome engineering specialist, announces that it has signed two exclusive license agreements with the Iowa State University that grant Collectis the worldwide right to use inventions related to TAL effector-nucleases (TALENs™) and monomeric TALENs™. These two exclusive licenses granted to Collectis cover <b>all uses of the TAL technologies in any field.</b> ”	26

<b>Lizenzgeber</b>	<b>Lizenznehmer</b>	<b>Verfahren</b>	<b>Jahr-Monat</b>	<b>Verwendungszweck</b>	<b>Quelle</b>
<i>Two Blades Foundation (2Blades) (USA)</i>	<i>Monsanto Company (USA)</i>	TAL Nuclease Technologies (TALEN)	2012-09	“2Blades announces the expansion of rights to Monsanto under our non-exclusive license, announced in April, 2012, for <b>broader access to the TAL Code technology</b> . 2Blades will continue to receive a grant back of improvements to the technology for use in 2Blades’ humanitarian projects.”	43
<i>Two Blades Foundation (2Blades) (USA)</i>	<i>KWS SAAT AG (D)</i>	TAL Nuclease Technologies (TALEN)	2012-07	“Two Blades Foundation (2Blades) has completed a non-exclusive license agreement with KWS SAAT AG (KWS) for access to 2Blades’ Transcription Activator Like (TAL) effector code technology <b>for genome engineering in certain crops</b> . KWS will grant improvements in the technology back to 2Blades for subsistence farming applications.”	42
<i>Two Blades Foundation (2Blades) (USA)</i>	<i>Bayer CropScience (D)</i>	TAL Nuclease Technologies (TALEN)	2012-05	“2Blades is pleased to announce completion of a non-exclusive license agreement with Bayer CropScience for the TAL code genome engineering technology. 2Blades will receive improvements to the TAL code for use in its subsistence farming applications.”	44
<i>Two Blades Foundation (2Blades) (USA)</i>	<i>Monsanto Company (USA)</i>	TAL Nuclease Technologies (TALEN)	2012-04	“The Two Blades Foundation (2Blades) has completed a non-exclusive license agreement with the Monsanto Company for access to the TAL Code technology <b>for genome engineering in plants</b> . ... 2Blades will gain access to Monsanto’s improvements to the technology for use in 2Blades’ humanitarian efforts in support of subsistence farming.”	41

<b>Lizenzgeber</b>	<b>Lizenznehmer</b>	<b>Verfahren</b>	<b>Jahr-Monat</b>	<b>Verwendungszweck</b>	<b>Quelle</b>
Two Blades Foundation (2Blades) (USA)	Syngenta (CH)	TAL Effector Technology (TALEN)	2012-01	“2Blades announces the signing of a non-exclusive license for the TAL Code technology to Syngenta <b>for commercial uses in crop plants</b> . Syngenta will grant 2Blades access to its improvements to the technology for use in 2Blades’ humanitarian efforts to support subsistence farming.”	23
Martin-Luther-University Halle-Wittenberg (D) via Two Blades Foundation (2Blades) (USA)	Life Technologies Corporation (seit 2014 zu: ThermoFisher Scientific) (USA)	TAL Effector Technology (TALEN)	2011-10	“The exclusive license, made jointly with the technology inventors [of Martin-Luther-University], will enable Life Technologies to <b>develop research tools for all applications</b> , as well as for <b>commercial non-plant uses...</b> ” ↓	27
Martin-Luther-University Halle-Wittenberg (D)	Two Blades Foundation (2Blades) (USA)	TAL Effector Technology (TALEN)	after 2009	“...2Blades retains the rights <b>for commercial applications in plants and green algae</b> and intends to make licenses broadly available.”	27
Dow AgroSciences (USA)	Oregon State University (USA)	EXZACT™ Precision Technology platform (ZFN)	2011-05	„Dow AgroSciences LLC (...) and Oregon State University have entered into a research agreement to apply EXZACT™ Precision Technology in trees, with the goal of <b>accelerating and enhancing research into tree improvement</b> . (...) Researchers at Oregon State University will make modifications to essential genes for flowering and reproduction.“	29



<b>Lizenzgeber</b>	<b>Lizenznehmer</b>	<b>Verfahren</b>	<b>Jahr-Monat</b>	<b>Verwendungszweck</b>	<b>Quelle</b>
Bayer CropScience (D)	KeyGene (NL)	KeyBase methodology (ODM)	2011-06	„Bayer CropScience and KeyGene have entered into an exclusive trait development agreement. Both companies will combine their expertise in the fields of protoplast technology and targeted molecular mutagenesis <b>to create novel traits for crop improvement</b> . The collaboration will initially focus on the use of KeyGene’s new and proprietary KeyBase methodology <b>to develop innovative traits for new oilseed rape varieties</b> . Bayer also has the option to expand the trait development alliance to include KeyBase-mediated development of proprietary Bayer and/or KeyGene traits in <b>cotton and rice</b> .“	38
Precision BioSciences Inc. (USA)	BASF Plant Science (D)	Directed Nuclease Editor™ (DNE) technology	2011-04	“BASF Plant Science and Precision BioSciences Inc., announced that they have entered into a collaborative agreement <b>to create site-specific genome modifications in plants</b> . The agreement provides BASF Plant Science with non-exclusive access to aspects of Precision BioSciences' proprietary Directed Nuclease Editor™ (DNE) technology, which can be used <b>to develop advanced agricultural products</b> .“	35

<b>Lizenzgeber</b>	<b>Lizenznehmer</b>	<b>Verfahren</b>	<b>Jahr-Monat</b>	<b>Verwendungszweck</b>	<b>Quelle</b>
University of Minnesota	Collectis (FRA)	Inventions related to TAL effector-mediated DNA recognition and cleavage (TALEN)	2011-01	“Collectis (...), the French genome engineering specialist, has announced today that it has signed an exclusive license agreement with the University of Minnesota that grants Collectis the worldwide right to use inventions related to TAL effector-mediated DNA recognition and cleavage. This revolutionary approach for the targeted modification of genomes was developed by the University of Minnesota and Iowa State University. <b>The exclusive license granted to Collectis covers all uses of the technology in any field.</b> ”	25
Dow AgroScience LLC (USA)	KWS SAAT AG (D)	EXZACT™ Precision Technology (ZFN)	2010-09	“Dow AgroSciences LLC, a wholly owned subsidiary of The Dow Chemical Company (...), announced today that it has entered into a <b>long-term research and product development agreement</b> , focused on the use of EXZACT™ Precision Technology, with KWS SAAT AG (KWS). Under the terms of the agreement, Dow AgroSciences will provide KWS with a <b>commercial license</b> option for traits and products developed with EXZACT Precision Technology <b>in sugar beets</b> , as well as <b>a research license for use in several row crops.</b> ”	39

<b>Lizenzgeber</b>	<b>Lizenznehmer</b>	<b>Verfahren</b>	<b>Jahr-Monat</b>	<b>Verwendungszweck</b>	<b>Quelle</b>
Dow AgroSciences LLC (USA)	Wageningen UR (University and Research center) (NL)	EXZACT™ Precision Technology (ZFN)	2010-09	“Dow AgroSciences LLC, a wholly owned subsidiary of The Dow Chemical Company (...), and the Plant Sciences Group of Wageningen UR (University and Research center) have entered into a research agreement to study how EXZACT™ Precision Technology <b>can improve the starch quality of potato, a food and industrial crop of global importance.</b> (...) This new research will extend (...) [the] functionalities [of the Technology] into potato, a crop that is difficult to breed using conventional methods.”	45
Dow AgroSciences LLC (USA)	Iowa State University (USA)	EXZACT™ Precision Technology (ZFN)	2010-04	“Dow AgroSciences LLC (...) and Iowa State University have entered into a research agreement to study how EXZACT™ Precision Technology can help <b>improve the development of renewable bioproducts in microalgae.</b> (...) As part of the agreement, researchers at Iowa State University will generate data demonstrating the utility of EXZACT™ in the microalgae Chlamydomonas, a model system for the green technologies that will produce the carbohydrates, lipids or hydrocarbons used in high-energy, renewable bioproducts. Dow AgroSciences is providing its technology as well as access to intellectual property, validated, high-quality zinc-finger reagents, and scientific expertise.”	33

<b>Lizenzgeber</b>	<b>Lizenznehmer</b>	<b>Verfahren</b>	<b>Jahr-Monat</b>	<b>Verwendungszweck</b>	<b>Quelle</b>
Dow AgroSciences LLC (USA)	Keygene N.V. (NL)	EXZACT™ Precision Technology (ZFN)	2010-01	“... announced today that they have entered into a <b>Trait Development Agreement</b> . This agreement will allow Dow AgroSciences and KeyGene to combine their experience and technologies <b>to develop traits for improved yield in tomatoes</b> . Under the terms of the agreement, Dow AgroSciences will provide KeyGene with access to EXZACT™ Precision Technology, its experience in targeted genome modification, and research support for use in a program focused on tomato yield enhancement. KeyGene will apply its expertise in molecular breeding, vegetable genetics and tomato protoplast technology to perform the research.”	36
Collectis (FRA)	Monsanto Company (USA)	Meganuclease technology	2009-09	“Monsanto Company (...) today announced a non-exclusive research and commercial license agreement with Collectis S.A. (...) <b>for broad use of its meganuclease technology in plants</b> . (...) Under the agreement, Monsanto will have access to Collectis’ intellectual property on meganucleases and its custom meganuclease production platform. Collectis will receive an upfront payment of €3 million, and subject to the approval of the Extraordinary General Meeting of Collectis’ shareholders, Monsanto will make an equity investment of €1 million to allow Collectis to scale the technology for agriculture. Collectis will also be eligible to receive fees for the development of each meganuclease, success-based milestones and may receive royalties on certain traits commercialized by Monsanto.”	16

<b>Lizenzgeber</b>	<b>Lizenznehmer</b>	<b>Verfahren</b>	<b>Jahr-Monat</b>	<b>Verwendungszweck</b>	<b>Quelle</b>
Sangamo BioSciences Inc. (USA)	Dow AgroSciences (USA)	Zinc finger technology (ZFP™)	2008-06	“... The license allows Dow AgroSciences to commercialize products incorporating or developed from plant cells using Sangamo's zinc finger DNA-binding protein (ZFP™) technology, in <b>agricultural crops, industrial products and plant-derived biopharmaceuticals</b> . Sangamo and Dow AgroSciences have been collaborating in research to apply ZFP technology to plants under a three-year research and commercial license option agreement initiated in October 2005. (...) In addition to developing its own new products using the ZFP technology, Dow AgroSciences will sublicense the technology to third parties for development of particular products under the trademark name of EXZACT™ Precision Traits. The trademark name emphasizes the specificity and the precision of the technology. It can be used with precision to add new genetic material, delete genes altogether and even regulate or edit native genes.”	24
Duke University (USA)	Precision BioSciences Inc. (USA)	Directed Nuclease Editor™ (DNE) technology	2006-04	“ <b>Precision BioSciences Secures Exclusive Worldwide License to Duke University's Directed Nuclease Editor Patent and Related Materials</b> . Precision BioSciences, Inc., a biotechnology company <b>developing a novel platform technology to precisely target genome modifications</b> , announced (...) that it has signed an exclusive worldwide license for the Directed Nuclease Editor technology developed at the Duke University Medical Center. The license agreement includes the patent application and related materials that have already been developed at Duke.”	20

<b>Lizenzgeber</b>	<b>Lizenznehmer</b>	<b>Verfahren</b>	<b>Jahr-Monat</b>	<b>Verwendungszweck</b>	<b>Quelle</b>
Sangamo BioSciences, Inc. (USA)	Dow AgroSciences LLC (USA)	Zinc finger technology (ZFP™)	2005-10	“Dow AgroSciences LLC, a wholly owned subsidiary of The Dow Chemical Company (...), and Sangamo BioSciences, Inc. (...) today announced the signing of a Research and Commercial License Agreement. The agreement provides Dow AgroSciences with <b>access to Sangamo's proprietary zinc finger DNA-binding protein (ZFP) technology for use in plants and plant cell cultures to develop products in</b> areas including, on an exclusive basis, <b>plant agriculture and industrial products</b> , and, on a non-exclusive basis, <b>animal health and biopharmaceutical products produced in plants.</b> ”	12
Bayer Crop Science (D)  Beteiligung an →	Arcadia Bioscience (USA)		2005-01	“Arcadia Biosciences, Inc., develops agricultural products for the improvement of agricultural crops. The company utilizes various technologies, both GM and non-GM, to develop its product portfolio, including precise genetic screening, advanced plant breeding techniques and genetic engineering. ...The main areas in which they are currently active include <b>agricultural technologies</b> (Nitrogen Use Efficiency, Salt Tolerance and Improved Process Efficiency) and <b>health technologies</b> (GLA Safflower Oil , Extended Shelf-Life Produce and Improved Nutrition Whole Foods). (...) Together with CMEA, Exeter Life Sciences and Saints Capital, [Bayer has] been involved with Arcadia since 2005.“	21

## Quellen

→ Zur Diskussion der komplizierten IP- und Lizenzsituation rund um CRISPR-Cas, siehe:

### **CRISPR, surrogate licensing, and scientific discovery**

Jorge L. Contreras and Jacob S. Sherkow (February 16, 2017) *Science* **355** (6326), 698-700. [doi: 10.1126/science.aal4222]. Download: <http://science.sciencemag.org/content/355/6326/698/tab-pdf>

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- 1 <https://www.genomeweb.com/applied-markets/ers-genomics-licenses-crisprcas9-evolva-industrial-applications>
- 2 <http://www.dowagro.com/en-us/newsroom/pressreleases/2016/10/monsanto-dow-agrosciences-global-licensing-agreement-exzact>
- 3 [http://www.cimmyt.org/press\\_release/dupont-pioneer-and-cimmyt-form-crispr-cas-publicprivate-partnership/](http://www.cimmyt.org/press_release/dupont-pioneer-and-cimmyt-form-crispr-cas-publicprivate-partnership/)
- 4 <http://news.monsanto.com/press-release/corporate/monsanto-announces-global-licensing-agreement-broad-institute-key-genome-edition>
- 5 <http://news.monsanto.com/press-release/corporate/monsanto-and-targetgene-announce-agreement-gene-editing-technology-advance-gene>
- 6 <http://www.businesswire.com/news/home/20160628005850/en/Monsanto-Nomad-Bioscience-Announce-Collaboration-Gene-Editing-Research>
- 7 <https://www.broadinstitute.org/news/licensing-crispr-agriculture-policy-considerations>
- 8 <https://www.pioneer.com/home/site/about/news-media/news-releases/template.CONTENT/guid.BAED75F2-4190-04E9-6549-0AA417910776>
- 9 <https://www.pioneer.com/home/site/about/news-media/news-releases/template.CONTENT/guid.00DA8BCD-A60A-E696-0179-E5BC63309087>
- 10 <http://www.calyxt.com/wp-content/uploads/2015/12/Calyxt-Press-Release-Research-Collaboration-16.12.15.pdf>
- 11 <http://www.agrivalda.com/news/releases/20140310.html>
- 12 <http://investor.sangamo.com/releasedetail.cfm?ReleaseID=246992>
- 13 <http://www.sigmaaldrich.com/technical-documents/articles/biology/crispr-use-license-agreement.html>
- 14 [http://www.cellectis-plantsciences.com/wp-content/uploads/2015/04/PR\\_CPS\\_CRISPR\\_04152015.pdf](http://www.cellectis-plantsciences.com/wp-content/uploads/2015/04/PR_CPS_CRISPR_04152015.pdf)
- 15 [http://www.dowagro.com/en-us/newsroom/pressreleases/2015/3/dow-agrosciences-and-caas-partner-to-accelerate-rice-research-and-product-development-in-](http://www.dowagro.com/en-us/newsroom/pressreleases/2015/3/dow-agrosciences-and-caas-partner-to-accelerate-rice-research-and-product-development-in)

china

- 16 <http://www.collectis.com/en/content/monsanto-licenses-use-collectis-innovative-genome-modification-technology-0>
- 17 <http://www.arcadiabio.com/news/press-release/dow-agrosciences-and-arcadia-biosciences-form-strategic-collaboration-develop-and>
- 18 [http://www.collectis.com/sites/default/files/pr\\_cps\\_bayercropscience\\_20140130\\_en.pdf](http://www.collectis.com/sites/default/files/pr_cps_bayercropscience_20140130_en.pdf)
- 19 <https://www.dowagro.com/en-us/newsroom/pressreleases/2014/5/dow-agrosciences-sigmaaldrich-announce-manufacturing-and-supply-agreement#.WCMG-YUq5o4>
- 20 <http://www.evaluategroup.com/Universal/View.aspx?type=Story&id=272706>
- 21 <http://www.basf-vc.de/index.php?id=5&L=1>
- 22 <http://2blades.org/2012/12/10/2blades-pioneer-tal-technology/>
- 23 <http://2blades.org/2012/01/16/2blades-announces-the-signing-of-a-non-exclusive-license-for-the-tal-code-technology-to-syngenta-for-commercial-uses-in-crop-plants-syngenta-will-grant-2blades-access-to-its-improvements-to-the/>
- 24 <http://investor.sangamo.com/releasedetail.cfm?releaseid=317375>
- 25 <http://www.collectis.com/en/content/collectis-acquires-exclusive-license-tal-effector-patents-university-minnesota-0>
- 26 <http://www.collectis.com/en/content/collectis-extends-its-tal-technology-intellectual-property-portfolio-through-acquisition-two>
- 27 <http://2blades.org/2011/06/10/2blades-announces-the-licensing-of-the-plant-rights-for-the-tal-effector-code-to-life-technologies-for-research-tool-applications/>
- 28 <http://2blades.org/2014/12/18/collectis-plant-sciences-and-two-blades-foundation-announce-the-execution-of-a-cross-license-agreement-on-tal-effector-nuclease-technologies/>
- 29 <http://newsroom.dowagro.com/press-release/dow-agrosciences-oregon-state-university-enter-research-agreement-tree-research-using->
- 30 [http://www.collectis.com/sites/default/files/collectis\\_precision\\_01302014\\_en.pdf](http://www.collectis.com/sites/default/files/collectis_precision_01302014_en.pdf)
- 31 <http://www.researchtriangle.org/news-and-events/nova-synthetix-and-precision-biosciences-announce-collaboration>
- 32 <http://www.businesswire.com/news/home/20140320005890/en/Danziger-Innovations-Precision-BioSciences-Announce-Successful-Genome>
- 33 <http://newsroom.dowagro.com/press-release/dow-agrosciences-iowa-state-university-enter-research-agreement-using-exzactm-precisi>
- 34 <http://newsroom.dowagro.com/press-release/dow-agrosciences-and-ics-caas-partner-accelerate-rice-research-and-product-development>



- 35 [http://www.agprofessional.com/news/basf\\_plant\\_science\\_licenses\\_precision\\_biosciences\\_site-specific\\_genome\\_modification\\_technology\\_120020659.html](http://www.agprofessional.com/news/basf_plant_science_licenses_precision_biosciences_site-specific_genome_modification_technology_120020659.html)
- 36 <http://newsroom.dowagro.com/press-release/2010/dow-agrosciences-keygene-enter-trait-development-agreement>
- 37 <http://www.agribusinessglobal.com/agrichemicals/biotech-firm-cibus-global-acquires-nucelis/>  
[http://www.seedquest.com/news.php?type=news&id\\_article=44051&id\\_region=&id\\_category=176&id\\_crop=](http://www.seedquest.com/news.php?type=news&id_article=44051&id_region=&id_category=176&id_crop=)
- 38 <http://seedworld.com/industry-news-2/>
- 39 <http://newsroom.dowagro.com/press-release/dow-agrosciences-kws-enter-agreement-research-product-development>
- 40 <http://sangamodomain.blogspot.de/2015/05/dow-agro-presentation-ezact-precision.html>
- 41 <http://2blades.org/2012/04/16/monsanto-has-completed-a-non-exclusive-license-with-2blades-for-commercial-uses-of-the-tal-code-technology-in-plants-improvements-to-the-technology-will-be-granted-back-for-2blades-humanitarian-pr/>
- 42 <http://2blades.org/2012/07/09/2blades-announces-the-completion-of-a-non-exclusive-license-with-kws-for-access-to-the-tal-code-technology-kws-will-grant-improvements-in-the-technology-back-to-2blades-for-subsistence-farming-appli/>
- 43 <http://2blades.org/2012/09/04/2blades-announces-the-expansion-of-rights-to-monsanto-under-our-non-exclusive-license-announced-in-april-2012-for-broader-access-to-the-tal-code-technology-2blades-will-continue-to-receive-a-gran/>
- 44 <http://2blades.org/2012/05/01/2blades-is-pleased-to-announce-completion-of-a-non-exclusive-license-agreement-with-bayer-cropsience-for-the-tal-code-genome-engineering-technology-2blades-will-receive-improvements-to-the-tal-code/>
- 45 <http://newsroom.dowagro.com/press-release/dow-agrosciences-wageningen-ur-enter-agreement-use-exzacttm-precision-technology>
- 46 <http://www.nasdaq.com/article/dow-chemical-inks-license-pact-with-agriculture-victoria-cm718982>
- 47 <https://www.basf.com/us/en/company/news-and-media/news-releases/2017/03/P-US-17-026.html>
- 48 [http://www.syngentacropprotection.com/news\\_releases/news.aspx?id=205353](http://www.syngentacropprotection.com/news_releases/news.aspx?id=205353)
- 49 <http://2blades.org/2016/12/14/2blades-partners-irri-provide-access-gene-editing-technology-rice/>
- 50 <http://www.agvic.com.au/news/latest-news/new-project-with-dow-agrosciences>
- 51 <https://seekingalpha.com/pr/16936340-arcadia-biosciences-accelerate-agricultural-trait-development-crispr-cas9>
- 52 <https://monsanto.pr/monsanto-announces-global-genome-editing-licensing-agreement-with-broad-institute-for-newly-characterized-crispr-system/>

53 <http://www.ersgenomics.com/press-release-2017-06-27.php>

54 <https://www.agdaily.com/news/monsanto-toolgen-crispr-platform/>

55 <https://www.broadinstitute.org/news/dupont-pioneer-and-broad-institute-join-forces-enable-democratic-crispr-licensing-agriculture>

56 <http://cariboubio.com/in-the-news/press-releases/genus-and-caribou-biosciences-announce-exclusive-collaboration-leading>