## 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**

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

*(UPDATE Stand: November 2018, Neue Einträge sind unterstrichen)*

| Kultur | Pflanze (Sorte) | Verfahren [a)] | Eigenschaften | Unternehmen [b)] | Entwicklungs-status [c)] | Freisetzungs-versuche | Quelle |
|---|---|---|---|---|---|---|---|
| Raps | Verschiedene Sorten | Rapid Trait Development System (RTDS™), ODM | Herbizidresistenz | ***Cibus*** (USA) | Zulassung USA (seit 2004), Kanada (seit 2014) **Anbau**: USA seit 2015, Kanada seit 2018 | USA, Kanada (2011), Schweden (vor 2014), UK | 1a,2a, 41a, 47a, 61a |
| Raps | Verschiedene Sorten, *Clearfield®-Production-System* | Rapid Trait Development System (RTDS™),ODM | Herbizidresistenz | **BASF** (D, USA), *Cibus* (USA) Zusammenarbeit seit 2007. Cibus CEO P. Beetham (2018, 62a): *„we did some work with them [BASF] for their Clearfield brand on tolerance of a different herbicide.“* | Vermutlich im Anbau, USA | UK (2013) | 17b, 60a, 62a |
| Raps | | TALEN | Veränderte Fettsäurezusammen-setzung | ***Calyxt Inc.*** (USA) | Forschung & Entwicklung, Phase I der Entwicklung abgeschlossen | nein | 29b, 57a, 63a |

| Kultur | Pflanze (Sorte) | Verfahren [a)] | Eigenschaften | Unternehmen [b)] | Entwicklungs-status [c)] | Freisetzungs-versuche | Quelle |
|---|---|---|---|---|---|---|---|
| Mais | Wachsmais | CRISPR | Veränderte Stärkezusammen-setzung | **DuPont Pioneer** (USA), *Caribou Biosciences (USA)* | APHIS-Beschied 2016, Kommerzialisierung geplant ab 2021 | USA, ab 2016 | 3a,4a, 5a, 48a, 64a, 65a |
| Mais | | CRISPR | Trockenheitstoleranz | **DuPont Pioneer** (USA), *Caribou Biosciences (USA)* | Kommerzialisierung geplant ab 2021 | USA, ab 2016 | 7a,8a, 8b, 31a, 65a |
| Mais | | CRISPR | Resistenz gegen Blattfleckenkrankheit | **DuPont Pioneer** (USA), *Caribou Biosciences (USA)* | APHIS-Bescheid 2018, Kommerzialisierung geplant ab ca. 2025 | unklar | 65a, 90a, 91a, 92a |
| Mais | | EXZACT™ precision tech-nology, ZFN | Herbizidresistenz, Veränderte Phytat-Biosynthese | **Dow AgroScience** (USA), *Sangamo (USA)* | Kurz vor der Kommer-zialisierung oder ev. bereits im **Anbau**, weitere Pflanzen (u. a. Raps) in Entwicklung → DOW: ZFN = „Key technology“. Wird ev. auch zum Trait-Stacking eingesetzt (66a, S. 6, 98a). | unklar | 1a, 19a, 20a, 21a, 40a, 66a, 98a |

| Kultur | Pflanze (Sorte) | Verfahren [a)] | Eigenschaften | Unternehmen [b)] | Entwicklungs-status [c)] | Freisetzungs-versuche | Quelle |
|---|---|---|---|---|---|---|---|
| Mais | | EXZACT™ precision tech-nology, ZFN | „The companies will jointly develop and commercialize agronomic yield traits, such as nutrient efficiency and water use efficiency, including several traits which have already completed advanced field trials in corn conducted by Dow AgroSciences.“ (98a) | **Dow AgroScience** (USA), **Arcadia Bioscience** (USA) | Forschung und Entwicklung, Freisetzungsversuche | This program is currently in field testing in multiple locations in the Midwest (99a, S. 4). | 98a, 99a |
| Mais | | CRISPR (SDN3 – CRISPR-Cpf1/Cms1) | Höherer Ertrag | ***Benson Hill Biosystems** (USA)* | Forschung & Entwicklung, APHIS-Bescheid 2018 | unklar | 85a, 86a, 87a |
| 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 (ev. Kanada) | 6a, 30a, 45a, 47a, 67a |
| Reis | | Rapid Trait Development System (RTDS™), ODM | Herbizidresistenz | ***Cibus** (USA)* | Kommerzialisierung geplant ab 2020 - 2023 | unklar | 6a, 67a |

| Kultur | Pflanze (Sorte) | Verfahren [a)] | Eigenschaften | Unternehmen [b)] | Entwicklungs-status [c)] | Freisetzungs-versuche | Quelle |
|---|---|---|---|---|---|---|---|
| Reis | | Rapid Trait Development System (RTDS™), ODM | Krankheitsresistenz | ***Cibus** (USA)* | Kommerzialisierung nach 2023 | unklar | 67a |
| Reis | | Cisgenese | Salztoleranz | Texas A&M University (USA), **Nexgen Plants Pty Ltd** (AUS) | APHIS-Bescheid 2018, „GE-rice cultivars are in the early phases of development" | geplant | 88a, 89a |
| Soja | | TALEN | Veränderte Fettsäurezusammen-setzung (*High oleic*) | ***Calyxt Inc.*** (USA) | APHIS-Bescheid 2015. Anbau in 3 US-Bundesstaaten auf 6500 ha Kommerzialisierung ab Ende 2018, Anf. 2019 als non-gm | Seit 2014 in den USA, Argentinien | 15a, 16a, 17a, 39a, 43a, 44a, 49a, 63a, 82a, 83a 100a |
| Soja | | TALEN | Veränderte Fettsäurezusammen-setzung (*High oleic*) & niedrige Linolensäure | ***Calyxt Inc.*** (USA) | APHIS-Bescheid 2015, Phase II der Entwicklung abgeschlossen | USA | 42a, 43a, 44a, 63a |
| Soja | 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 [a)] | Eigenschaften | Unternehmen [b)] | Entwicklungs-status [c)] | Freisetzungs-versuche | Quelle |
|---|---|---|---|---|---|---|---|
| Soja | | EXZACT™ precision tech-nology, ZFN | Abiotic stress, Stacking verschiedener Traits incl. Herbizidtoleranz | **Dow Agroscience**, **Arcadia Bioscience**, **Bioceres** (USA) | Ankündigung der Zusammenarbeit erfolgte 2015 | wahrscheinlich | 97a |
| Soja | | CRISPR? | Verschiedene Traits: Herbizidtoleranz, Trockentoleranz | **DonMario Semillas** (Argentinien) | Kommerzialisierung ab 2025 | unklar | 94a, 95a |
| Kartoffel | Innate™ 1 Generation & 2 Generation (Russet Burbank, Ranger Russet, Atlantic) | Intragenese Cisgenese RNAi | Resistenz gegen Kraut- und Knollenfäule Weniger anfällig für grau-schwarze Flecken (an Druckstellen), Weniger Acrylamide, Lagerung bei kühleren Temperaturen | ***J.R. Simplot*** (USA) Auseinandersetzung zwischen Simplot und einem ehemaligen Mitarbeiter, der warnt, die Kartoffeln seien nicht ausreichend auf Risiken getestet worden (68a, 69a). | 1. Generation: **Anbau** 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), sehr wenig (Kanada) | 1 Generation: mehrere Jahre auf Prince Edward Island (Kanada) 2 Generation: über 2 Jahre an 11 Standorten (USA) | 1a, 13a, 29a, 32a, 33a, 34a, 68a, 69a, 70a |
| Kartoffel | | TALEN | Bessere Lagereigenschaften bei kühlen Temperaturen | ***Calyxt Inc.*** (USA) | Kommerzialisierung ab 2019, APHIS-Bescheid 2014, Phase II der Entwicklung abgeschlossen | USA, ab 2015 | 22a, 23a, 24a, 36a, 63a |
| Kartoffel | | TALEN | Weniger Acrylamid-Bildung beim Frittieren/*non-browning* | ***Calyxt Inc.*** (USA) | APHIS-Bescheid 2016, Phase I der Entwicklung abgeschlossen | unklar | 25a, 26a, 35a, 57a, 63a |

| Kultur | Pflanze (Sorte) | Verfahren [a)] | Eigenschaften | Unternehmen [b)] | Entwicklungs-status [c)] | Freisetzungs-versuche | Quelle |
|---|---|---|---|---|---|---|---|
| Kartoffel | | Rapid Trait Development System (RTDS™),ODM | Resistenz gegen Kraut- und Knollenfäule | ***Cibus** (USA)* | Kommerzialisierung ab 2023 | unklar | 6a,67a |
| Kartoffel | | Rapid Trait Development System (RTDS™),ODM | Herbizidresistenz | ***Cibus** (USA)* | Kommerzialisierung ab 2023 | unklar | 67a |
| Weizen | | CRISPR | Hybridweizen | **DuPont Pioneer** (USA), *Caribou Biosciences* (USA) | Kommerzialisierung geplant ab 2021 | USA, ab 2016 | 7a, 8a, 72a |
| Weizen | MLO_KO Weizen | TALEN | Mehltauresistenz | ***Calyxt Inc.*** (USA) | APHIS-Bescheid 2016, Phase II der Entwicklung abgeschlossen | Ja | 21b, 22b, 57a, 63a |
| Weizen | | TALEN | Erhöhter Ballaststoffgehalt | ***Calyxt Inc.*** (USA) | Forschung & Entwicklung, Phase I der Entwicklung abgeschlossen, APHIS-Bescheid 2018 | ja | 50b, 63a, 79a, 80a, 81a, 93a |
| Weizen | | TALEN | Herbizidresistenz | **Calyxt Inc.** (USA) | Forschung & Entwicklung, Phase I der Entwicklung abgeschlossen | nein | 52b, 63a |

| Kultur | Pflanze (Sorte) | Verfahren [a)] | Eigenschaften | Unternehmen [b)] | Entwicklungs-status [c)] | Freisetzungs-versuche | Quelle |
|---|---|---|---|---|---|---|---|
| Apfel | Arctic Apple „Arctic Granny“ „Arctic Golden“ „Arctic Fuji" | Intragenese RNAi | Keine braune Verfärbung nach Anschneiden | **Okanagan Speciality Fruits** (USA) | **Anbau**, Arctic Golden (vorgeschnitten) seit Ende 2017 in 400 Supermärkten im Mittleren Westen (USA). 2018: Getrocknete Apfelstücke, exklusiv über Amazon[i] | USA, Kanada | 1a, 13a, zum Arctic Fuji s. 28a, 59a, 73a, 74a |
| Leindotter | Trait C3008a | CRISPR | Erhöhter Ölgehalt | **Yield10 Bioscience, Metabolix Oilseeds, Inc.** (USA, Kanada) | APHIS-Bescheid 2017 | Ja, bislang im kleineren Masstab (USA) | 49a, 50a, 51a, 75a, 78a, 96a |
| Leindotter | Traits: C3008a, C3008b, C3009 | CRISPR (Multiplexing) | Erhöhter Ölgehalt | **Yield10 Bioscience, Metabolix Oilseeds, Inc.** (USA, Kanada) | APHIS-Bescheid 2018 | geplant | 75a, 76a, 77a, 78a, 96a |
| Alfalfa/Luzerne | | TALEN | Verbesserte Nährstoffzusammen-setzung | ***Calyxt Inc.*** (USA), **S&W Seed Company** (USA) | APHIS-Bescheid 2017, Phase I der Entwicklung abgeschlossen | Unklar, eher nein (s. Quelle 52a) | 49a, 52a, 53a, 63a, 84a |

**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 / Meganuklease

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

2a= 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

5a= 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

8a= 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

10a= 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

12a= www.vistivegold.com/

13a= 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

16a= 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

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

20a= 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

26a= 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

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

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

30a= 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

36a= https://www.aphis.usda.gov/biotechnology/downloads/reg_loi/aphis_response_cellectis_potato.pdf

37a= 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.cellectis.com/en/content/cellectis-plant-sciences-reports-generation-high-oleic-soybean-journal-plant-biotechnology-0

40a= 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

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

47a= 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

52a= http://www.calyxt.com/products/

53a= 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

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

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

61a= https://www.grainews.ca/2018/02/08/new-non-gmo-canola-variety-for-the-market/

62a= https://geneticliteracyproject.org/2018/06/19/whats-in-the-crispr-drawer-for-farming-and-food/

63a= http://www.calyxt.com/wp-content/uploads/2018/10/Calyxt-Investor-Presentation-Oct-2018.pdf

64a= https://www.pioneer.com/home/site/us/agronomy/library/crispr-cas/

65a= http://www.ilsijapan.org/ILSIJapan/LEC/biotech/GenEd2017/06Gutterson.pdf

66a= https://s21.q4cdn.com/813101928/files/doc_downloads/DowDuPont-2017-Annual-Report.PDF

67a= https://www.cibus.com/crops.php

68a= https://www.gmwatch.org/en/news/latest-news/18575-gmo-potato-creator-now-fears-its-impact-on-human-health

69a= http://www.innatepotatoes.com/newsroom/view-news/j.r.-simplot-company-statement-on-caius-rommens-book

70a= http://www.potatogrower.com/2017/07/innate-acreage-low-in-canada

71a= https://ausveg.com.au/app/uploads/publications/Potatoes-Australia_June-July_Web.pdf

72a= https://www.ncbi.nlm.nih.gov/pubmed/29959585

73a= https://www.thepacker.com/article/gm-arctic-apples-heating-retail

74a= https://fruitgrowersnews.com/article/qa-with-developer-of-the-gmo-non-browning-arctic-apple/

75a= https://www.yield10bio.com/sites/default/files/YTEN%20Investor%20SlideDeck_WebSite_9_11_18.pdf

76a= https://www.aphis.usda.gov/biotechnology/downloads/reg_loi/18-142-01_air_inquiry_cbidel.pdf

77a= https://www.aphis.usda.gov/biotechnology/downloads/reg_loi/18-142-01_air_response_signed.pdf

78a= https://www.agritechtomorrow.com/article/2018/09/yield10-bioscience-with-dr-oliver-peoples/11000

79a= https://www.aphis.usda.gov/biotechnology/downloads/reg_loi/17-038-01_air_inquiry_cbidel.pdf

80a= https://www.aphis.usda.gov/biotechnology/downloads/reg_loi/17-038-01_air_response_signed.pdf

81a= http://www.calyxt.com/calyxt-harvests-high-fiber-wheat-field-trials/

82a= http://www.calyxt.com/calyxt-signs-agreement-with-american-natural-processors-to-crush-and-process-its-high-oleic-soybeans/

83a= http://www.calyxt.com/calyxt-inks-agreement-with-kemx-global-to-refine-high-oleic-soybean-oil/

84a= http://www.calyxt.com/calyxt-and-sw-seed-company-announce-milestone-in-alfalfa-seed-development-program/

85a= https://www.aphis.usda.gov/biotechnology/downloads/reg_loi/17-298-01_air_inquiry_cbidel.pdf

86a= https://www.aphis.usda.gov/biotechnology/downloads/reg_loi/17-298-01_air_response_signed.pdf

87a= http://bensonhillbio.com/2018/11/01/enabling-gene-editing-to-be-a-truly-enable-technology-part-iii/

88a= https://www.aphis.usda.gov/biotechnology/downloads/reg_loi/17-286-01_01_air_inquiry.pdf

89a= https://www.aphis.usda.gov/biotechnology/downloads/reg_loi/17-286-01_air_response_signed.pdf

90a= https://www.aphis.usda.gov/biotechnology/downloads/reg_loi/17-076-01_air_inquiry_cbidel.pdf

91a= https://www.aphis.usda.gov/biotechnology/downloads/reg_loi/17-076-01_air_inquiry_a1_cbidel.pdf

92a= https://www.aphis.usda.gov/biotechnology/downloads/reg_loi/17-076-01_air_response_signed.pdf

93a= http://www.capitalpress.com/Nation_World/20180405/high-fiber-gene-edited-wheat-cleared-for-commercialization

94a= http://efarmnewsar.com/2018-09-07/don-mario-in-seven-years-we-will-be-launching-soybeans-obtained-by-nbt.html

95a= https://www.donmario.com/en/products/

96a= http://ir.yield10bio.com/news-releases/news-release-details/yield10-bioscience-announces-plans-its-2018-field-test-program

97a= http://www.dowagro.com/en-us/newsroom/pressreleases/2015/4/dow-agrosciences-arcadia-biosciences-and-bioceres-collaborate-to-develop-and-commercialize-soybean-traits

98a= https://arcadiabio.com/2015/12/02/dow-agrosciences-and-arcadia-biosciences-form-strategic-collaboration-to-develop-and-commercialize-corn-traits/

99a= http://www.annualreports.com/HostedData/AnnualReports/PDF/NASDAQ_RKDA_2016_2d51cabd96a0445cbb4977b00324d2cd.pdf

100a= https://www.transgen.de/aktuell/2724.usa-genom-editierte-sojabohnen-ohne-gentechnik.html

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

*(UPDATE Stand: November 2018, Neue Einträge sind unterstrichen)*

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

| Kultur | Pflanze | Verfahren [a)] | Eigenschaften | Unternehmen [b)] | Entwicklungs-status [c), d)] | Freisetzungs-versuche | Quelle |
|---|---|---|---|---|---|---|---|
| Raps | | TALEN | Herbizidresistenz | ***Calyxt inc.*** (USA) | Forschung & Entwicklung | nein | 52b, 63a |
| Raps | Trait C3007 | CRISPR | Erhöhter Ölgehalt | **Yield10Bioscience** (USA) | Forschung & Entwicklung | nein | 75a, 78a |
| Raps | | ARCUS® genome-editing technology | Rapsöl mit einem geringeren Gehalt an gesättigten Fettsäuren | **Cargill**, *Precision BioScience* (USA) | Forschung & Entwicklung | nein | 94b |
| Mais | | CRISPR | Resistenz gegen *Maize Lethal Necrosis Disease* | **DuPont Pioneer** (USA), CIMMYT (MEX) | Forschung & Entwicklung Maissorten sollen für afrikanische Kleinbauern entwickelt werden | unklar | 53b, 88b |
| Mais | | CRISPR | Forschung an Genfunktionen | Iowa State University (USA) | Forschung [d)] APHIS-Bescheid 2018 | geplant | 57b, 58b |
| Mais | | CRISPR | SDN-1, Gen Knock Outs in Wee, ATM, ATR | Vlaams Instituut voor Biotechnologie (VIB) (BEL) | Forschung [d)] Freisetzungsversuche laufen seit 2017, erst seit 2018 im EU-GMO Register | Seit 2017-2018 | 72b, 73b |

| Kultur | Pflanze | Verfahren [a)] | Eigenschaften | Unternehmen [b)] | Entwicklungs-status [c), d)] | Freisetzungs-versuche | Quelle |
|---|---|---|---|---|---|---|---|
| Mais | | CRISPR (CRISPR-Cpf1/Cms1) | Photosynthetic efficiency trait, Ertragssteigerung | ***Benson Hill Biosystems***, **Beck's** (USA) | Forschung & Entwicklung, anticipate filing a regulatory dossier with the USDA by 2021 | Nein (Elitelinien: ja) | 95b |
| Mais | | Meganuklease | Veränderte Stärkezusammen-setzung | ***Agrivida Inc.*** (USA) | APHIS-Bescheid 2015 | unklar | 23b, 24b |
| Kartoffel<br><br>in NL: Freisetzung BEENDET | | Cisgenese | Kraut- und Knollenfäuleresistenz | Universität Wageningen (NL) | Forschung [d)], DuRPh-Projekt 2006 - 2016 | Vor 2018: NL, Irland (89b), Belgien<br>In CH seit 2015 - 2019 | 1b, 32b, 89b |
| Kartoffel<br><br>in UK: Freisetzung BEENDET | | Cisgenese | Kraut- und Knollenfäuleresistenz | Biotechnology and Biological Sciences Research Council (BBSRC) (UK) | Forschung [d)] | Freisetzungs-versuche (UK), 2010 - 2012 | 1b |
| Kartoffel<br><br>Forschungsprojekt vermutlich BEENDET | Bintje | Cisgenese | Resistenz gegen Kraut- und Knollenfäule | Ghent University, Vlaams Instituut voor Biotechnologie (VIB), Institute for Agricultural and Fisheries Research (ILVO) (BEL) | Kommerzialisierung unklar | nein | 37a, 58a |

| Kultur | Pflanze | Verfahren [a)] | Eigenschaften | Unternehmen [b)] | Entwicklungs-status [c), d)] | Freisetzungs-versuche | Quelle |
|---|---|---|---|---|---|---|---|
| Kartoffel | Maris Piper, Agria | Cisgenese ev. RNAi | Resistenz gegen Kraut- und Knollenfäule, Kartoffelzysten-nematoden, geringere Anfälligkeit gegen Druckstellen | TSL Potato Partnership Project (The Sainsbury Laboratory), University of Leeds, **J. R. Simplot**, **BioPotatoes UK Ltd** (USA, UK) | ev. Kommerzialisierung ab 2025 | Freisetzungsversuche 2016 – 2019 (UK) | 38a, 71a, 90b |
| Kartoffel | | TALEN | Kraut- und Knollenfäule-Resistenz | ***Calyxt Inc.*** (USA) | Forschung & Entwicklung | nein | 52b, 63a |
| Kartoffel | | TALEN | Verbesserte Lagerfähigkeit bei kühlen Temperaturen, *non-browning* | ***Calyxt Inc.*** (USA) | Forschung & Entwicklung | nein | 52b, 63a |
| Soja | | TALEN | Verbesserte Protein-Zusammensetzung | ***Calyxt Inc.*** (USA) | Forschung & Entwicklung | nein | 52b, 63a |
| Soja | | TALEN | Trockentoleranz | ***Calyxt Inc.*** (USA) | Forschung & Entwicklung | nein | 52b, 63a |
| Soja | | TALEN | Erhöhter Ertrag | ***Calyxt Inc.*** (USA) | Forschung & Entwicklung | nein | 52b, 63a |
| Soja | | TALEN | Herbizidresistenz | ***Calyxt Inc.*** (USA) | Forschung & Entwicklung | nein | 52b, 63a |
| Soja, Sorghum, Weizen | | CRISPR | Herbizidresistenz | *Benson Hill Biosystems* (USA), **Bioheuris** (USA) | Forschung & Entwicklung | geplant | 64b |

| Kultur | Pflanze | Verfahren [a)] | Eigenschaften | Unternehmen [b)] | Entwicklungs-status [c), d)] | Freisetzungs-versuche | Quelle |
|---|---|---|---|---|---|---|---|
| Weizen | | CRISPR | Verschiedene Eigenschaften in Planung | **DuPont Pioneer** (USA), CIMMYT (MEX) | Forschung & Entwicklung Weizensorten sollen für afrikanische Kleinbauern entwickelt werden | nein | 88b |
| Weizen | | TALEN | Reduzierter Glutengehalt | ***Calyxt Inc.*** (USA) | Forschung & Entwicklung | nein | 30b, 52b, 63a |
| Weizen | | TALEN | Erhöhter Ballaststoffgehalt | ***Calyxt Inc.*** (USA) | Forschung & Entwicklung | nein | 52b, 63a |
| Weizen | | CRISPR | Gluten“freier“ Weizen | Institute for Sustainable Agriculture in Cordoba (ES) | Forschung & Entwicklung | Ja, Ort unklar “The GM wheat is currently being tested in 30 celiac patients from Mexico and Spain and so far the results are very encouraging.” (82b) | 54b, 81b 82b |

| Kultur | Pflanze | Verfahren [a)] | Eigenschaften | Unternehmen [b)] | Entwicklungs-status [c), d)] | Freisetzungs-versuche | Quelle |
|---|---|---|---|---|---|---|---|
| Hartweizen | | CRISPR | Gluten“freier“ Hartweizen | Institute for Sustainable Agriculture in Cordoba (ES) | Forschung & Entwicklung “A number of companies have expressed interest in the technology and in using the material as it is or incorporating it into their breeding programs.” (81b) | unklar | 81b |
| Weizen | Traits C4001, C4003 | CRISPR | Verbesserte Photosyntheseleistung mehr Pflanzenbiomasse | **Yield10Bioscience** (USA) | Forschung & Entwicklung | Nein | 75a, 78a |
| Gerste<br><br>in DK: Freisetzung BEENDET | | Cisgenese | Verbesserte Phytase-Aktivität | Aarhus Universität (DK) | Forschung [d)] | Dänemark, 2012 - 2016 | 1b |
| Reis | | TALEN | Resistenz gegen eine bakterielle Krankheit | *State University of Iowa, Prof. Bing Yang* (USA) | APHIS-Bescheid 2015, Forschung | Sommer 2014, Universitäts-gelände, Iowa | 25b, 26b |
| Reis | Traits C4001, C4003 | CRISPR | Verbesserte Photosyntheseleistung erhöhte Pflanzenbiomasse | **Yield10Bioscience** (USA) | Forschung & Entwicklung | Nein | 75a |
| Reis | | CRISPR | Ertragssteigerung | Purdue University (USA), Chinese Academy of Sciences (China)[ii] | Forschung [d)] | Ja, Shanghai, Hainan Island | 77b, 78b |

| Kultur | Pflanze | Verfahren [a)] | Eigenschaften | Unternehmen [b)] | Entwicklungs-status [c), d)] | Freisetzungs-versuche | Quelle |
|---|---|---|---|---|---|---|---|
| Tomate | | CRISPR | Früchte lösen sich ohne Stielansatz beim Pflücken | University of Florida, Horticultural Sciences (USA) | Forschung [d)] APHIS-Bescheid 2018 | unklar | 59b, 60b |
| Tomate | | CRISPR | Performing a proof-of-concept of a new method of rapid and efficient gene editing in a tomato plant | UC Davis Plant Biology Department, **TechAccel** (USA) | Forschung und Entwicklung | geplant | 74b |
| Kassava | | CRISPR | Krankheitsresistenz | Donald Danforth Plant Science Center (USA), Virus Resistant Cassava for Africa (VIRCA) | Forschung & Entwicklung | Wahrscheinlich (Kenia, Uganda) | 67b, 68b |
| Alfalfa/Luzerne | | Intragenese | Niedriger Ligningehalt | **J. R. Simplot** (USA) | Forschung & Entwicklung | unklar | 1b, 91b |
| Alfalfa/Luzerne | | TALEN | Herbizidresistenz | ***Calyxt inc.*** (USA) | Forschung & Entwicklung | nein | 52b, 63a |
| Leindotter | Trait C3007 | CRISPR | Erhöhter Ölgehalt | **Yield10Bioscience** (USA) | Forschung & Entwicklung | nein | 75a, 78a |

| Kultur | Pflanze | Verfahren [a)] | Eigenschaften | Unternehmen [b)] | Entwicklungs-status [c), d)] | Freisetzungs-versuche | Quelle |
|---|---|---|---|---|---|---|---|
| Leindotter | | CRISPR | Erhöhter Ölgehalt (Omega-3-Fettsäure) | Rothamsted Reserach (UK) | Forschung [d)] 2 mittels CRISPR veränderte Kontrolllinien. Sollen entfernt werden. Angaben im EU-GMO Register zu konv. GVO-Linien. Wenn erneut mit CRISPR-Pflanzen gearbeitet wird, wird neuer Antrag fällig (DEFRA an GM Freeze. Brief nicht öffentlich). | Ja, UK seit 2018 (- 2020) | 69b, 70b, 71b |
| Tabak | | Meganuklease | Geringerer Nikotingehalt | North Carolina State University (USA), **Precision Bioscience** (USA) | APHIS-Bescheid 2018, Forschung (unklar ob Entwicklung) | unklar | 61b, 62b, 63b |
| Apfel, Birne | | Pfropfen auf GV-Unterlage | Veränderte Wurzel-eigenschaften, Einfluss der GV-Unterlage auf Wachstum, Blüte etc. | Swedish University of Agricultural Sciences (SWE) | Forschung [d)] (unklar ob Entwicklung) | Schweden, 2015 - 2019 | 1b, 15b, 34b |

| Kultur | Pflanze | Verfahren [a)] | Eigenschaften | Unternehmen [b)] | Entwicklungs-status [c), d)] | Freisetzungs-versuche | Quelle |
|---|---|---|---|---|---|---|---|
| Apfel | | Cisgenese | Erhöhter Anthocyan-Gehalt | Stichting Dienst Land-bouwkundig Onderzoek (DLO), Stichting Dienst Landbouwkundig Onderzoek (DLO) in particular Praktijk-onderzoek Plant, Om-geving / Plant Research International (PPO/PRI)(NL) | Forschung [d)] | NL, 2016 - 2026 | 1b, 11b, 33b |
| Apfel | | Cisgenese | Feuerbrandresistenz | ETH Zürich (CH), Agroscope (CH) | Forschung [d)] | Mit Auflagen in CH bewilligt 2016 - 2019 | 1b, 12b |
| Apfel | | Cisgenese | Schorfresistenz | ETH Zürich (CH), Universität Wageningen (NL) | Forschung [d)], teilweise Regulierung, APHIS 2012 (siehe Quelle 47b) | NL, 2011 - 2021 | 1b, 47b, 92b |
| Apfel, Birne | | unbekannt | Feuerbrandresistenz | **Okanagan Speciality Fruits** (USA) | Forschung & Entwicklung | unklar | 27b, 75b |
| Apfel | | unbekannt | Schorfresistenz | **Okanagan Speciality Fruits** (USA) | Forschung & Entwicklung | unklar | 27b, 75b |
| Pflaume, Aprikose | | Pfropfen auf GV-Unterlage | u. a.Trockenheits-toleranz | Centro de Edafología y Biología del Segura (ES) | Forschung [d)] | Spanien, 2015 - 2018 | 1b, 16b, 35b |

| Kultur | Pflanze | Verfahren [a)] | Eigenschaften | Unternehmen [b)] | Entwicklungs-status [c), d)] | Freisetzungs-versuche | Quelle |
|---|---|---|---|---|---|---|---|
| Pfirsich | | unbekannt | Resistenz gegen *Plum pox virus* | **Okanagan Speciality Fruits** (USA) | Forschung & Entwicklung | unklar | 27b, 75b |
| Physalis | | CRISPR | Verschiedene: Fruchtgrösse, Vorerntefruchtfall, Invasivität | Physalis Improvement Project, Boyce Thompson Institute (USA) | Forschung & Entwicklung | unklar | 65b, 66b |
| Walnuss | | Pfropfen auf GV-Unterlage | Resistenz gegen *Crown Gall disease* | Department of Pomology, University of California (USA) | Forschung und Entwicklung, gemäss OECD-Workshop (2b): „Close to commercialization" Bislang keine APHIS-Anfrage | unklar | 43b, 2b, 93b |
| Erdbeere | | Cisgenese, TALEN | Ertragssteigerung, verbessertes *Shelf life*, erhöhter Zuckergehalt, Krankheitsresistenz | **J. R. Simplot** (USA) | Forschung & Entwicklung Patentanmeldung (USA), 2018 | Ja, ab 2015 | 38b, 39b, 76b |
| Weinrebe | *Vitis rotundifolia Muscadinia* | Cisgenese | Pilzresistenz, Kernlosigkeit | University of Florida (USA) | USDA-gefördertes Projekt, Kommerzialisierung geplant | Seit 2016 | 86b, 87b |
| Weinrebe | | Intragenese | Erhöhter Anthocyan-Gehalt | University of Florida (USA) | APHIS-Bescheid 2012 | wahrscheinlich | 1b, 44b, 46b |

| Kultur | Pflanze | Verfahren [a)] | Eigenschaften | Unternehmen [b)] | Entwicklungs-status [c), d)] | Freisetzungs-versuche | Quelle |
|---|---|---|---|---|---|---|---|
| Weinrebe | | Pfropfen auf GV-Unterlage | Resistenz gegen die bakterielle *Pierce disease* | Department of Viticulture and Enology, University of California (USA) | Forschung & Entwicklung, gemäss OECD-Workshop (2b): „Product development for commercialization" | Quelle 85b nennt gentechnisch veränderte Trauben, keine GV-Unterlagen | 2b, 45b, 85b |
| Weinrebe<br><br>In FRA: Forschungsprojekt BEENDET | | Pfropfen auf GV-Unterlage | Resistenz gegen Reisigkrankheit | French National Institute for Agricultural Research (INRA) (FRA) | Forschung [d)] | ab 2010, Dauer unbekannt. Keine Versuche mehr. Zwei Versuche in Colmar wurden zerstört. | 44b, 83b, 84b |
| Pappel<br><br>WURDE NIE BEGONNEN? | | CRISPR Transgenese | Grundlagenforschung | Umeå University, Department of Plant Physiology (SWE) | Forschung [d)] Keine Angaben zu CRISPR-Bäumen im EU-GMO Register. | Geplant war: 2016 – 2021, Schweden Unklar ob Versuch je begonnen wurde | 31b |
| Pilze | Weisser Champignon | CRISPR | Keine braune Verfärbung nach Anschneiden, verbessertes *Shelf-life* | Prof. Yinong Yang, Pennsylvania State University (USA) | Forschung & Entwicklung, Keine Kommerzialisierung (s. Quelle 18a) | nein | 9a,10a 18a |
| | Grüne Borstenhirse (*Setaria viridis*) | CRISPR | Blühverfrühung | Donald Danforth Plant Science Center (USA) | APHIS-Bescheid 2017, Forschung [d)] | unklar | 48b, 49b |

| Kultur | Pflanze | Verfahren [a)] | Eigenschaften | Unternehmen [b)] | Entwicklungs-status [c), d)] | Freisetzungs-versuche | Quelle |
|---|---|---|---|---|---|---|---|
| | Acker-Schmalwand (*Arabidopsis thaliana*) | CRISPR | Protein PsbS („Sicherheitsventil“ in der Photosynthese) wurde ausgeschaltet | Umeå Plant Science Centre and Umeå University (SWE) | Forschung [d)] Unklar, ob Freisetzungsversuch noch läuft. Keine Angaben im EU-GMO Register | Ab Sommer 2016, Schweden | 19b, 20b |
| | Acker-Hellerkraut (*Thlaspi arvense)* | CRISPR | Veränderter/erhöhter Ölgehalt im Samen | Illinois State University, Department of Biological Sciences (USA) | Forschung [d)] APHIS-Bescheid 2018 | geplant | 55b, 56b |

**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 / Meganukleasen

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

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

3b= www.testbiotech.org/node/1433

4b= www.producer.com/2016/01/herbicide-tolerant-flax-project-progressing/

5b= 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/

7b= 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

10b= www.vistivegold.com/

11b= 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

13b= 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

15b= 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

17b= www.genewatch.org

18b= 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#.el6YplL62

21b= 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

23b= 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

25b= 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

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

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

34b= 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

36b= 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.freisetzungen-gentechnik-usa-eu.html

39b= 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

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

47b= 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

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

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/

55b= https://www.aphis.usda.gov/biotechnology/downloads/reg_loi/18-036-01_a1_air_inquiry_cbidel.pdf

56b= https://www.aphis.usda.gov/biotechnology/downloads/reg_loi/18-036-01_air_response_signed.pdf

57b= https://www.aphis.usda.gov/biotechnology/downloads/reg_loi/18-110-01_air_inquiry_cbidel_a2.pdf

58b= https://www.aphis.usda.gov/biotechnology/downloads/reg_loi/18-110-01_air_response_signed.pdf

59b= https://www.aphis.usda.gov/biotechnology/downloads/reg_loi/18-051-01_a1_air_inquiry.pdf

60b= https://www.aphis.usda.gov/biotechnology/downloads/reg_loi/18-051-01_air_response_signed.pdf

61b= https://www.aphis.usda.gov/biotechnology/downloads/reg_loi/17-126-01_air_inquiry.pdf

62b= https://www.aphis.usda.gov/biotechnology/downloads/reg_loi/17-126-01_air_support_cbidel.pdf

63b= https://www.aphis.usda.gov/biotechnology/downloads/reg_loi/17-126-01_air_response_signed.pdf

64b= http://bensonhillbio.com/2018/05/10/new-companies-use-new-tools-to-create-new-choices-for-farmers/

65b= https://www.nature.com/articles/s41477-018-0259-x

66b= https://btiscience.org/our-research/bti-physalis-project/

67b= https://www.wired.com/story/european-ruling-could-slow-africas-push-for-crispr-crops/

68b= https://www.danforthcenter.org/scientists-research/research-institutes/institute-for-international-crop-improvement/crop-improvement-projects/virca?__sw_csrfToken=1BzDBRKLkDyY1azPvzYkJJkQW2PPJDw9

69b= https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/708560/gmo-camelina-oleic-acre-advice.pdf.pdf

70b= http://gmoinfo.jrc.ec.europa.eu/gmp_report.aspx?CurNot=B/GB/18/01

71b= https://www.gmfreeze.org/press-releases/defra-issues-a-free-pass-on-new-gm-technique/

72b= http://gmoinfo.jrc.ec.europa.eu/gmp_report.aspx?CurNot=B/BE/18/V8

73b= https://www.greenpeace.org/eu-unit/issues/nature-food/1260/unauthorised-gmo-field-trial-exposed-as-eu-takes-hands-off-approach-greenpeace/

74b= http://techaccel.net/2018/06/techaccel-announces-uc-davis-stair-grant-award-for-novel-gene-editing-approach/

75b= https://www.okspecialtyfruits.com/about-osf/future-products/

76b= http://www.freepatentsonline.com/20180092319.pdf

77b= https://geneticliteracyproject.org/2018/05/23/crispr-rice-increases-grain-yield-more-than-25-in-chinese-field-trials/

78b= http://www.pnas.org/content/115/23/6058

79b= http://www.emergtoplifesci.org/content/1/2/169

8 0 b = https://www.bmel.de/SharedDocs/Downloads/Landwirtschaft/Pflanze/GrueneGentechnik/NMT_Stand-Regulierung_Anlage4-Aktualisierung.pdf?__blob=publicationFile

81b= https://www.globalrust.org/blog/francisco-barro-developer-gluten-free-wheat-deliver-keynote-address-bgri-technical-workshop

82b= http://www.isaaa.org/kc/cropbiotechupdate/newsletter/default.asp?Date=10/4/2017#15826

83b= https://www.theguardian.com/world/2010/aug/24/raid-destruction-french-gm-vines

84b= http://palatepress.com/2011/06/wine/will-grapegrowers-and-consumers-accept-gmo-wines/

85b= https://www.westernfarmpress.com/grapes/grape-vine-resistance-pierces-disease-within-decade

86b= https://vivo.usda.gov/display/NIFA-0225619-PROJ#time

87b= https://ageconsearch.umn.edu/bitstream/232281/2/1_Fonsah.pdf

88b= http://www.ilsijapan.org/ILSIJapan/LEC/biotech/GenEd2017/03Dhugga.pdf

89b= https://www.teagasc.ie/news--events/news/2018/gm-potato-environmental-.php

90b= https://gtr.ukri.org/projects?ref=BB%2FM017834%2F1

91b= https://www.ncbi.nlm.nih.gov/pubmed/17851774?dopt=Abstract

92b= http://gmoinfo.jrc.ec.europa.eu/gmp_report.aspx?CurNot=B/NL/10/05

93b= http://www.berkeleybioeconomy.com/wp-content/uploads//2013/05/Transgenic%20rootstock%20based%20managementXX.pdf

94b= http://precisionbiosciences.com/cargill-leverages-new-technology-precision-biosciences-develop-ultra-low-saturate-high-oleic-canola-oil/

95b= https://bensonhillbio.com/2018/05/14/groundbreaking-new-trait-partnership-announced-to-provide-greater-choice-to-farmers/

i Anfang Oktober 2018 führte Okanagan Specialty Fruits (OSF) 10 ausgewählte Medienvertreter, Blogger und Ernährungswissenschaftler durch die Apfelanlagen, um sie über die weiteren Pläne des Unternehmens zu informieren (siehe auch Quelle: 73a).

Zu diesen Plänen gehört:

- Adding fresh-cut Arctic Grannys to retail availability, and releasing golden and granny smith ApBits to retailers (whole apples in both varieties will be in 2-pound bags);
- Expanding production — OSF is harvesting on 60 acres this season and plans to have 180 acres in production next year and 560 in 2020;
- Expanding planted acreage — there are about 600 acres of Arctic variety trees, with another 800 planned for next year;
- Opening the first phase of a massive facility in Royal City by the end of 2019. The 100,000-square-foot initial phase will grow to about 1 million square feet by the mid-2020s, with pre-grading lines, slicing lines, dehydration equipment for ApBitz and lines for packing whole, fresh Arctics;
- More varieties — The company has received approval to grow non-browning fujis from the U.S. Department of Agriculture (waiting on Food and Drug Administration's OK) and is working on gala approval; and
- Licensing growers in other areas, including the Southern Hemisphere. OSF is working with authorities and a potential growing partner in Argentina.

ii Die Situation in China ist, insbesondere was Freisetzungsversuche angeht, unklar.
Der USDA-Gain-Report zu China (GAIN Report Number: CH 17054, 12/29/2017, p. 8) schreibt: "China allows field trials of biotech crops for the purpose of import approval and research, but does not provide data on the number of field trials or types of crops / traits being tested."

Zu Forschung im Bereich Genome Editing (p. 8, siehe auch Quellen: 79b, 80b):
"Chinese scientists associated with the China Academy of Sciences and the China Academy of Agricultural Sciences are making impressive progress in innovative biotechnology and have published dozens of papers about CRISPR technology."

# Lizenzvereinbarungen und Kooperationen

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

## im Bereich der neuen gentechnischen Verfahren – landwirtschaftliche Anwendungen (2005 – 2018)

*(UPDATE Stand: November 2018, 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." Einträge in der Datenbank reichen nur bis 2017.*

| ***Lizenzgeber*** | ***Lizenznehmer*** | ***Verfahren*** | ***Jahr-Monat*** | ***Verwendungszweck*** | ***Quelle*** |
|---|---|---|---|---|---|
| *Two Blades Foundation (2Blades) (USA)* | *Epicrop Technologies Inc. (USA)* | TAL code technology | 2018-11 | **Non-exclusive licence agreement.** "We are pleased to be able to utilize this technology in our research t**o improve yields and stress tolerance in crops**" said Michael Fromm, CEO of Epicrop. "Research with this technology will help us to more efficiently optimize our conventional breeding methods **for improving epigenetics in crops**. Epigenetics is a form of biological information that has always been present in plants, and can be improved by plant breeding as we learn what features are most beneficial for higher stress tolerance and yields in the farmer's field. It may seem surprising, to those more familiar with gene editing and other methods, that our epigenetic breeding methods produce | 61 |

| *Lizenzgeber* | *Lizenznehmer* | *Verfahren* | *Jahr-Monat* | *Verwendungszweck* | *Quelle* |
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| | | | | plants that do not contain any changes to their genome sequence or introduce any foreign DNA sequences. Epigenetic improvements are analogous to a 'software update' that helps the plant's natural genetics perform better without changing the 'hardware' of the genetic sequences." | |
| *Broad Institute (USA)* | *BASF* | CRISPR-Cpf1 | 2018-10 | "BASF has attained a **global, non-exclusive licensing agreement** with the Broad Institute of MIT and Harvard for the use of CRISPR-Cpf1 genome editing technology t**o improve products in agricultural** and industrial microbiology **applications**." | 57 |
| *Corteva Agriscience™, Agriculture Division of DowDuPont™, Broad Institute (USA)* | *J. R. Simplot* | CRISPR-Cas9 and related gene editing tools | 2018-08 | "Comprehensive intellectual property rights allow entities to apply scientific tools as widely as possible. To enable such access, Corteva Agriscience™ and Broad Institute have agreed on a joint **non-exclusive licensing framework for agricultural use**. The license to Simplot represents the first time that Corteva Agriscience™ and Broad Institute have jointly provided a license of CRISPR-Cas9 genome editing tools to an agricultural company." | 58 |
| *Corteva Agriscience™, Agriculture Division of DowDuPont™, Broad Institute (USA)* | *Yield10Bioscience (USA)* | CRISPR-Cas9 | 2018-08 | "For the **use of CRISPR-Cas9 genome-editing technology for crops**. The joint license covers intellectual property consisting of approximately 48 patents and patent applications on CRISPR-Cas9 technology controlled by the Broad Institute and Pioneer. Under the agreement, Yield10 has the option to renew the license on an annual basis and the right to convert the research license to a commercial license in the future, subject to customary conditions as specified in the agreement." | 59 |

| *Lizenzgeber* | *Lizenznehmer* | *Verfahren* | *Jahr-Monat* | *Verwendungszweck* | *Quelle* |
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| *Precision BioScience (USA)* | *Cargill (USA)* | ARCUS® genome-editing technology | 2018-02 | "Together, the partners are using Precision's ARCUS® genome-editing technology **to further reduce saturated fat in canola oil**, putting Cargill at the forefront of a next-generation innovation. (…) This commitment to saturated fat reduction led to Cargill's partnership with Precision BioSciences in 2014. Since then, the two companies have worked together to lower saturate levels in canola oil, leveraging Cargill's expertise in gene identification, and Precision BioSciences' unique technology that edits the targeted genes." | 60 |
| *Broad Institute* (USA) | *Syngenta* (China, CH) | CRISPR-Cas9 | 2017-11 | "Syngenta announced (...) it has attained a non-exclusive IP license from the Broad Institute of MIT and Harvard for **CRISPR-Cas9 genome-editing technology for agricultural applications**. CRISPR-Cas9 genome editing technology complements Syngenta's already robust plant breeding innovation toolbox. **Syngenta is applying this technology in multiple crops, including corn, wheat, tomato, rice and sunflower**." | 48 |

| ***Lizenzgeber*** | ***Lizenznehmer*** | ***Verfahren*** | ***Jahr-Monat*** | ***Verwendungszweck*** | ***Quelle*** |
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| *Broad Institute* (USA)<br><br>**+**<br><br>*to jointly provide* ***non-exclusive licenses to foundational CRISPR-Cas9 intellectual property*** *under their respective control* ***for use in commercial agricultural research and product development*** | *DuPont Pioneer (USA)* | CRISPR-Cas9 | 2017-10 | "DuPont Pioneer and the Broad Institute of MIT and Harvard announced (...) that they have reached an agreement to **jointly provide non-exclusive licenses to foundational CRISPR-Cas9 intellectual property under their respective control for use in commercial agricultural research and product development**. 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 **will be freely available to universities and nonprofit organizations for academic research**. (…)" | 55 |
| *Broad Institute* (USA) | *Arcadia Bioscience Inc. (USA)* | CRISPR-Cas9 | 2017-09 | "Arcadia Biosciences, Inc. (...), an agricultural technology company, announced (...) that it has signed a **global licensing agreement** with the Broad Institute of MIT and Harvard **for research use of the CRISPR- Cas9 genome-editing technology in agriculture**. The technology will enable Arcadia to accelerate the research and development of its agricultural nutrition and productivity traits." | 51 |

| ***Lizenzgeber*** | ***Lizenznehmer*** | ***Verfahren*** | ***Jahr-Monat*** | ***Verwendungszweck*** | ***Quelle*** |
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| *ToolGen* (USA) | *Monsanto (USA)* | CRISPR-technology platform | 2017-08 | "Monsanto and ToolGen, a biotechnology company specializing in genome editing, have reached a **global licensing agreement for the use of ToolGen's CRISPR technology platform to develop agricultural products**. 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 |
| *DuPont Pioneer* (USA) | *ERS Genomics* | CRISPR-Cas | 2017-06 | "DuPont Pioneer (DuPont) and ERS Genomics (ERS) announced a **technology license agreement** whereby **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**. 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 |

| *Lizenzgeber* | *Lizenznehmer* | *Verfahren* | *Jahr-Monat* | *Verwendungszweck* | *Quelle* |
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| *Broad Institute* (USA) | *BASF (Germany)* | CRISPR-Cas9 | 2017-03 | "BASF (...) announced that it has reached a **global licensing agreement** with the Broad Institute of MIT and Harvard for the **use of CRISPR-Cas9 genome-editing technology to improve products in agricultural** and industrial microbiology **applications**." | 47 |
| *Broad Institute (USA)* | *Monsanto (USA)* | CRISPR-Cpf1 | 2017-03 | "Monsanto Company announced that it has reached a new **global licensing agreement** with the Broad Institute of MIT and Harvard for the **use of the novel CRISPR-Cpf1 genome-editing technology in agriculture**. 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 |
| *Two Blades Foundation (2Blades)* (USA) | *International Rice Research Institute (IRRI)* (Philippines) | TAL code technology | 2016-12 | "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 **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**. (…) 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 |

| ***Lizenzgeber*** | ***Lizenznehmer*** | ***Verfahren*** | ***Jahr-Monat*** | ***Verwendungszweck*** | ***Quelle*** |
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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.” | |
| *Dow AgroSciences LLC* (USA) | *Department of Environment and Primary Industries (DEPI)* via *Agriculture Victoria Services Pty Ltd.* (Australia) | 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. ***The commercial license agreement aims at the development of forage grass varieties and related fungal endophytes produced using precision genome editing technologies.*** 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 |
| *Dow AgroSciences LLC* (USA) | *Monsanto Company* (USA) | EXZACT™ Precision Technology Platform (ZFN) | 2016-10 | “For ***research and commercial development of new crop solutions*** across Monsanto Company’s research portfolio.” | 2 |
| *DuPont Pioneer* (USA) | *International Maize & Wheat Improvement Center/CIMMYT* (Mexico) | CRISPR-Cas | 2016-09 | “This collaboration with DuPont Pioneer will allow us ***to provide climate and disease resilient varieties*** more quickly to smallholder farmers in the developing world.” (CIMMYT Director General Martin Kropff) | 3 |

| ***Lizenzgeber*** | ***Lizenznehmer*** | ***Verfahren*** | ***Jahr-Monat*** | ***Verwendungszweck*** | ***Quelle*** |
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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 ***use of CRISPR technology in agriculture. But with important restrictions.*** 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 ***to deliver continuous improvements in agriculture***. 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 ***aimed at enhancement of agricultural crops***. 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 |

| ***Lizenzgeber*** | ***Lizenznehmer*** | ***Verfahren*** | ***Jahr-Monat*** | ***Verwendungszweck*** | ***Quelle*** |
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| *Caribou Bioscience* (USA) | *Genus* (USA) | CRISPR-Cas9-technology platform | 2016-05 | "Genus plc (...), a global pioneer in animal genetics, and Caribou Biosciences, Inc. (...), are pleased to announce a **multi-year strategic collaboration** where **Genus receives a worldwide, exclusive license to Caribou's leading CRISPR-Cas9 gene editing technology platform in certain livestock species**. (…) The agreement gives Genus exclusive access to Caribou's CRISPR-Cas9 technology **for the development of new traits in pigs, cattle and potentially other livestock species**. 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 |
| *Institute of Genetics and Developmental Biology* (IGDB), *Chinese Academy of Sciences* (China) via *Plant Bioscience Limited* (PBL) (UK) | *Calyxt, Inc.* (USA) | TALEN | 2015-12 | "… signed a research collaboration and option to exclusive licenses with Plant Bioscience Limited (PBL) ***for certain new crop plants developed using gene editing*** by the Institute of Genetics and Developmental Biology (IGDB) of the Chinese Academy of Sciences in Beijing. *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*." | 10 |

| ***Lizenzgeber*** | ***Lizenznehmer*** | ***Verfahren*** | ***Jahr-Monat*** | ***Verwendungszweck*** | ***Quelle*** |
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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 t***o develop and commercialize new breakthrough yield traits and trait stacks in corn***. 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 ***to enhance and accelerate the development of trait stacks.*** 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 ***cross-licensed their respective patent portfolios***, with DuPont receiving exclusive intellectual property rights for CRISPR-Cas ***technology applications in major row crops***, and non-exclusive rights **in other agricultural and industrial bioscience applications**. … the alliance between DuPont and Caribou involves a multi-year ***research collaboration*** with scientists from the two organizations focused on ***enhancing the breadth, versatility and efficiency of the core CRISPR-Cas toolkit***. DuPont also has made a minority equity investment in Caribou to further strengthen the working relationship.” | 9 |

| ***Lizenzgeber*** | ***Lizenznehmer*** | ***Verfahren*** | ***Jahr-Monat*** | ***Verwendungszweck*** | ***Quelle*** |
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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 ***EXZACT™ Precision Genome Editing Technology to be used in rice in China***. Dow AgroSciences and ICS-CAAS scientists ***will collaboratively develop an industry-leading rice genome editing technology platform.***" | 34 |
| *Vilnius University, Institute of Biotechnology* (Lithuania) | *DuPont Pioneer* (USA) | CRISPR-Cas9 | 2015-06 | "… announced a technology license and ***research collaboration agreement*** with Vilnius University ***to further the technical and commercial utility of guided Cas9 genome editing technology.*** Under the agreement, DuPont receives an exclusive license to Vilnius University intellectual property *for all commercial uses, including in agriculture*." | 8 |

| ***Lizenzgeber*** | ***Lizenznehmer*** | ***Verfahren*** | ***Jahr-Monat*** | ***Verwendungszweck*** | ***Quelle*** |
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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 Victory, Australia, through its commercial arm, Agriculture Victoria Services Pty Ltd. (AVS), strengthened a ***collaborative agreement to improve the performances of Australian canola varieties***. The project uses the EXZACT™ Precision Genome Editing Technology platform ***to continue developing new varieties of canola with enhanced performance*** designed to benefit farmers in Australia and globally. In addition, AVS will also use the EXZACT™ Precision Genome Editing Technology platform ***to enhance the genetics of crops important to Australian primary producers***.“ | 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 ***to use the technology covered by the patent rights of the family WO/2014/144155 entitled “Engineering Plant Genomes Using CRISPR/Cas Systems”***.” | 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 ***research program with mutual development goals***. Dow AgroSciences and CAAS scientists will also work together to make sure that Dow AgroSciences’ expertise is best combined with CAAS’ expertise ***to accelerate rice research and product development in China***.” | 15 |

| ***Lizenzgeber*** | ***Lizenznehmer*** | ***Verfahren*** | ***Jahr-Monat*** | ***Verwendungszweck*** | ***Quelle*** |
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| *Two Blades Foundation (2Blades)* (USA)<br><br>⇄ | *Cellectis plant sciences, Inc.* (FRA)<br><br>Kreuzlizenzierung | 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 ***for not-for-profit uses***, including use in 2Blades' ***humanitarian efforts to support subsistence farming***, and for certain ***commercial applications related to the disease resistance programs*** of 2Blades. In addition (…) Cellectis plant sciences receives a license under 2Blades' TAL Code technology related to nucleases ***for commercial uses in certain specified crop plants***. Cellectis plant sciences has an option ***to expand its license to additional crops***." | 28 |

| ***Lizenzgeber*** | ***Lizenznehmer*** | ***Verfahren*** | ***Jahr-Monat*** | ***Verwendungszweck*** | ***Quelle*** |
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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) | 2014-08 | "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 **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**." | 50 |

| ***Lizenzgeber*** | ***Lizenznehmer*** | ***Verfahren*** | ***Jahr-Monat*** | ***Verwendungszweck*** | ***Quelle*** |
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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, ***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*** of the EXZACT Precision Technology ***to enable precision transformation, trait stacking and targeted mutagenesis in plants***." | 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 ***have successfully generated site-specific genome modifications in petunia and jasmine tobacco*** 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 |

| ***Lizenzgeber*** | ***Lizenznehmer*** | ***Verfahren*** | ***Jahr-Monat*** | ***Verwendungszweck*** | ***Quelle*** |
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| *Precision BioSciences* (USA) | *Agrivida* (USA) | Directed Nuclease EditorTM (DNE) Technology | 2014-03 | "Precision BioSciences and Agrivida revealed today that they have entered into a ***trait development collaboration*** based on precise gene modifications made possible by Precision's Directed Nuclease EditorTM (DNE) Technology. The collaboration recently delivered the first modified genes that are the subject of Agrivida ***commercialization efforts in the area of animal nutrition***." (***Corn Traits for Improved Dairy and Beef Nutrition***). | 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 t***o generate non-GM, ricin-free castor plants*** 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 ***improved castor variants capable of producing user defined oil profiles*** 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 |

| ***Lizenzgeber*** | ***Lizenznehmer*** | ***Verfahren*** | ***Jahr-Monat*** | ***Verwendungszweck*** | ***Quelle*** |
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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 ***has acquired Nucelis***, 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. ***Nucelis will continue to be the exclusive licensee to Cibus' Rapid Trait Development System (RTDS) technology*** in its key ***product areas of fermentation and bio-based chemicals***." | 37 |
| *Cellectis plant sciences* (FRA) ⇄ | *Precision BioSciences* (USA) Kreuzlizenzierung | Meganuclease technology | 2014-01 | "Precision BioSciences, Inc. and Cellectis 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 ***cross-license certain genome engineering patents*** 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 |

| ***Lizenzgeber*** | ***Lizenznehmer*** | ***Verfahren*** | ***Jahr-Monat*** | ***Verwendungszweck*** | ***Quelle*** |
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| *Cellectis plant sciences* (FRA) | *Bayer CropScience* (D) | Gene editing | 2014-01 | "Cellectis 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 ***to introduce targeted modifications to selected plant genes and genomes***. (…) The first aim of this extended partnership is to collaboratively ***create commercial traits for the canola seed market*** using new technologies developed by Cellectis plant sciences. The second aim is to provide Bayer with access to technologies that enable the directed engineering of plant genomes, such as ***gene stacking and targeted mutagenesis***, for the development of improved crops." | 18 |
| *Two Blades Foundation (2Blades)* (USA) | *DuPont Pioneer* (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 f***or uses in certain crops***. Improvements to the technology will be granted back for 2Blades' humanitarian projects benefiting subsistence farming." | 22 |
| *Iowa State University* (USA) | *Cellectis plant sciences, Inc.* (FRA) | Inventions related to TAL effector-nucleases (TALENs™) and monomeric TALENs™ | 2012-10 | "Cellectis (…), the genome engineering specialist, announces that it has signed two exclusive license agreements with the Iowa State University that grant Cellectis the worldwide right to use inventions related to TAL effector-nucleases (TALENs™) and monomeric TALENs™. These two exclusive licenses granted to Cellectis cover ***all uses of the TAL technologies in any field***." | 26 |

| ***Lizenzgeber*** | ***Lizenznehmer*** | ***Verfahren*** | ***Jahr-Monat*** | ***Verwendungszweck*** | ***Quelle*** |
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| *Two Blades Foundation (2Blades)* (USA) | *Monsanto Company* (USA) | TAL Nuclease Technologies (TALEN) | 2012-09 | "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 grant back of improvements to the technology for use in 2Blades' humanitarian projects." | 43 |
| *Two Blades Foundation (2Blades)* (USA) | *KWS SAAT AG* (D) | 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 ***for genome engineering in certain crops***. KWS will grant improvements in the technology back to 2Blades for subsistence farming applications." | 42 |
| *Two Blades Foundation (2Blades)* (USA) | *Bayer CropScience* (D) | 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 |
| *Two Blades Foundation (2Blades)* (USA) | *Monsanto Company* (USA) | 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 ***for genome engineering in plants***. … 2Blades will gain access to Monsanto's improvements to the technology for use in 2Blades' humanitarian efforts in support of subsistence farming." | 41 |

| ***Lizenzgeber*** | ***Lizenznehmer*** | ***Verfahren*** | ***Jahr-Monat*** | ***Verwendungszweck*** | ***Quelle*** |
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| *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 ***for commercial uses in crop plants***. 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 ***develop research tools for all applications,*** as well as for ***commercial non-plant uses***…." ↓ | 27 |
| *Martin-Luther-University Halle-Wittenberg* (D) | *Two Blades Foundation (2Blades)* (USA) | TAL Effector Technology (TALEN) | after 2009 | "...2Blades retains the rights ***for commercial applications in plants and green algae*** 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 ***accelerating and enhancing research into tree improvement.*** (…) Researchers at Oregon State University will make modifications to essential genes for flowering and reproduction." | 29 |

| ***Lizenzgeber*** | ***Lizenznehmer*** | ***Verfahren*** | ***Jahr-Monat*** | ***Verwendungszweck*** | ***Quelle*** |
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| *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 ***to create novel traits for crop improvement***. The collaboration will initially focus on the use of KeyGene's new and proprietary KeyBase methodology ***to develop innovative traits for new oilseed rape varieties***. Bayer also has the option to expand the trait development alliance to include KeyBase-mediated development of proprietary Bayer and/or KeyGene traits in ***cotton and rice***." | 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 ***to create site-specific genome modifications in plants***. 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 ***to develop advanced agricultural products***." | 35 |

| ***Lizenzgeber*** | ***Lizenznehmer*** | ***Verfahren*** | ***Jahr-Monat*** | ***Verwendungszweck*** | ***Quelle*** |
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| *University of Minnesota* | *Cellectis* (FRA) | Inventions related to TAL effector-mediated DNA recognition and cleavage (TALEN) | 2011-01 | "Cellectis (…), the French genome engineering specialist, has announced today that it has signed an exclusive license agreement with the University of Minnesota that grants Cellectis 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. ***The exclusive license granted to Cellectis covers all uses of the technology in any field***." | 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 ***long-term research and product development agreement***, 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 ***commercial license*** option for traits and products developed with EXZACT Precision Technology ***in sugar beets***, as well as ***a research license for use in several row crops***." | 39 |

| ***Lizenzgeber*** | ***Lizenznehmer*** | ***Verfahren*** | ***Jahr-Monat*** | ***Verwendungszweck*** | ***Quelle*** |
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| *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 ***can improve the starch quality of potato****, a food and industrial crop of global importance.* (...) 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 ***improve the development of renewable bioproducts in microalgae***. (…) 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 |

| ***Lizenzgeber*** | ***Lizenznehmer*** | ***Verfahren*** | ***Jahr-Monat*** | ***Verwendungszweck*** | ***Quelle*** |
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| *Dow AgroSciences LLC* (USA) | *Keygene N.V.* (NL) | EXZACT™ Precision Technology (ZFN) | 2010-01 | "… announced today that they have entered into a ***Trait Development Agreement.*** This agreement will allow Dow AgroSciences and KeyGene to combine their experience and technologies ***to develop traits for improved yield in tomatoes***. 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 |
| *Cellectis* (FRA) | *Monsanto Company* (USA) | Meganuclease technology | 2009-09 | "Monsanto Company (...) today announced a non-exclusive research and commercial license agreement with Cellectis S.A. (...) ***for broad use of its meganuclease technology in plants***. (…) Under the agreement, Monsanto will have access to Cellectis' intellectual property on meganucleases and its custom meganuclease production platform. Cellectis will receive an upfront payment of €3 million, and subject to the approval of the Extraordinary General Meeting of Cellectis' shareholders, Monsanto will make an equity investment of €1 million to allow Cellectis to scale the technology for agriculture. Cellectis 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 |

| ***Lizenzgeber*** | ***Lizenznehmer*** | ***Verfahren*** | ***Jahr-Monat*** | ***Verwendungszweck*** | ***Quelle*** |
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| *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 ***agricultural crops, industrial products and plant-derived biopharmaceuticals***. 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 | "***Precision BioSciences Secures Exclusive Worldwide License to Duke University's Directed Nuclease Editor Patent and Related Materials.*** Precision BioSciences, Inc., a biotechnology company ***developing a novel platform technology to precisely target genome modifications***, 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 |

| ***Lizenzgeber*** | ***Lizenznehmer*** | ***Verfahren*** | ***Jahr-Monat*** | ***Verwendungszweck*** | ***Quelle*** |
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| *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 ***access to Sangamo's proprietary zinc finger DNA-binding protein (ZFP) technology for use in plants and plant cell cultures to develop products in*** areas including, on an exclusive basis, ***plant agriculture and industrial products***, and, on a non-exclusive basis, ***animal health and biopharmaceutical products produced in plants.***" | 12 |
| *Bayer Crop Science* (D)<br><br>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 ***agricultural technologies*** (Nitrogen Use Efficiency, Salt Tolerance and Improved Process Efficiency) and ***health technologies*** (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

→ Einen Einblick in die Patentsituation geben die Studien:

**CRISPR Patent Landcape, Januar 2018. IP Studies**

Einen Auszug der Studie: https://www.ipstudies.ch/wordpress/wp-content/uploads/2018/06/2018.01-CRISPR-Patent-Landscape_SampleV2.pdf

Ganze Studie: 3990,00.- EUR (https://www.ipstudies.ch/crispr-patent-analytics/)

**CRISPR Patent Landscape. IRunway**

http://insights.i-runway.com/acton/fs/blocks/showLandingPage/a/4977/p/p-008c/t/page/fm/1

Zu den **breiten Ansprüchen rund um CRISPR-Cas9:**

CRISPR–Cas9 claim sets and the potential to stifle innovation

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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/

4 http://news.monsanto.com/press-release/corporate/monsanto-announces-global-licensing-agreement-broad-institute-key-genome-edi

5 http://news.monsanto.com/press-release/corporate/monsanto-and-targetgene-announce-agreement-gene-editing-technology-advance-g

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.agrivida.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

15 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.cellectis.com/en/content/monsanto-licenses-use-cellectis-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.cellectis.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.cellectis.com/en/content/cellectis-acquires-exclusive-license-tal-effector-patents-university-minnesota-0

26 http://www.cellectis.com/en/content/cellectis-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/cellectis-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.cellectis.com/sites/default/files/cellectis_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-exzacttm-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

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=

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-cropscience-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

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

57 https://www.basf.com/en/company/news-and-media/news-releases/2018/10/p-IR-181024.html

58 http://www.simplot.com/news/simplot_secures_license_from_corteva_agriscience_mit_harvard

59 https://synbiobeta.com/yield10-bioscience-signs-research-license-agreement-covering-crispr-cas9/

60 http://precisionbiosciences.com/cargill-leverages-new-technology-precision-biosciences-develop-ultra-low-saturate-high-oleic-canola-oil/

61 http://2blades.org/2018/11/05/2blades-announces-completion-of-a-non-exclusive-license-with-epicrop-technologies-inc-for-access-to-the-tal-code-technology/