

Neue gentechnische Verfahren: Kommerzialisierungspipeline im Bereich Pflanzenzüchtung und Lizenzvereinbarungen



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Marktentwicklungen im Bereich der neuen Gentechnik

Die wichtigsten Ergebnisse zusammengefasst:

Insgesamt befinden sich mindestens **7 Pflanzen**, die mit Hilfe der neuen gentechnischen Verfahren entwickelt wurden, **im Anbau**. Mindestens **5 Pflanzen** befinden sich im «**vor-kommerziellen**» **Anbau** (Saatgutvermehrung etc.). Zu weiteren (mind.) **15 Pflanzen**, die bereits eine **Anbauzulassung** haben, liegen bezüglich Anbau zu wenig gesicherte Daten vor. Mindestens **22 Pflanzen** sollen, nach Unternehmensangaben, in den nächsten Jahren auf den Markt kommen.

Im Jahr 2024 wurde die erste **EU-Importzulassung** für eine Pflanze erteilt, die (auch) mittels CRISPR entwickelt wurde. Der **Mais (DP915635)** des US-Unternehmens Corteva ist resistent gegen das Herbizid Glufosinat und produziert ein Insektengift, das in bestimmten Baumfarnen vorkommt.¹

Das Produktportfolio der kleineren Start-Ups entwickelt sich nach wie vor dynamisch. Ein weiteres Unternehmen (*Yield10 Bioscience*) musste 2024 Insolvenz anmelden. **41 Projekte** (darunter auch reine Freisetzungs-/Forschungsprojekte) sind 2024 **neu hinzugekommen**.

Die Recherche ergab **eine neue Lizenzvereinbarung**. Um die weitere Forschung und Entwicklung mit CRISPR zu ermöglichen, erleichtern sowohl die **Syngenta Group**,² als auch **ERS Genomics**³ ihr CRISPR-Portfolio für (reine) Forschungseinrichtungen. Neben Lizenzvereinbarungen spielen auch die Patente im Bereich CRISPR eine wichtige und kontrovers diskutierte Rolle. 2024 sind hierzu verschiedene umfangreiche Studien vorgelegt worden, darunter der Bericht: „**CRISPR technology: Patent & License landscapes**“, der im Auftrag des *Swiss Federal Institute of Intellectual Property* (IGE) 2024 veröffentlicht wurde.⁴

1 <https://www.isaaa.org/gmaprovaldatabase/event/default.asp?EventID=601>, <https://efsa.onlinelibrary.wiley.com/doi/10.2903/j.efsa.2024.8490>

2 <https://www.syngentagroup.com/newsroom/2024/syngenta-opens-rights-genome-editing-and-breeding-technologies-boost-agricultural-0>

3 <https://ersgenomics.com/express-license/>

4 https://www.ige.ch/fileadmin/user_upload/recht/national/e/20231388_IPI_CRISPR_Patent_License_Landscape_revised_Final_16_02_24.pdf

1. Welche neuen gv-Pflanzen sind auf dem Markt/steht kurz vor der Markteinführung?

a) Neue gv-Pflanzen auf dem Markt

Gemäss eigenen Erhebungen gibt es (mind.) 7 Pflanzen, die bereits angebaut und vermarktet werden:

- Die «**GABA-Tomate**» (erhöhter Gehalt an *Gamma-Amino-Buttersäure*) des Unternehmens *Sanatech Seed*. Anbau: Japan. Seit 2024 hat die Tomate eine [Anbauzulassung auf den Philippinen](#). *Sanatech Seed* plant, die Tomate auch in den [USA auf den Markt](#) zu bringen.
- Der **GreenVenus™-Salat** des US-Unternehmens *Green Venus* (Ausgründung von *Intrexon*). Der Salat hat ein verlängertes *Shelf-life* und zeigt eine verringerte enzymatische Bräunungsreaktion (an verletzten Blättern). Seit 2024 ist der Salat auch für [Hausgärtner](#) erhältlich. Darüber hinaus arbeitet *Green Venus* auch an (*non-browning*) [Avocado](#) und verschiedenen [Weintrauben](#). Diese befinden sich vermutlich bereits im (vor-kommerziellen) Anbau (siehe unten).
- Ein **Senf mit verbessertem Geschmack** (reduzierten Bitterstoffen) von *Pairwise* wurde 2023 unter dem Markennamen [Conscious™ Greens](#) in den USA auf den Markt gebracht. Im April 2023 hat [Health Canada](#) den Senf auf die Liste der "*non-novel foods*" aufgenommen. *Conscious™ Greens* war zunächst nur in einigen Restaurants erhältlich. Ab 2025 soll der Salat auch in den Handel kommen. Nachdem sich *Pairwise* 2024 aus der Vermarktung des Salates zurückgezogen hat, wird der Vertrieb nun durch [Bayer](#) organisiert. Im [Mai 2024](#) gab *Pairwise* bekannt, dass das Unternehmen eine (weitere) exklusive Lizenzvereinbarung mit *Bayer* abgeschlossen hat. Die Vereinbarung sieht vor, dass *Bayer*, aufbauend auf dem von *Pairwise* entwickelten Senf mit reduzierten Bitterstoffen, **zehn weitere Genom-editierte (Senf-)Salate** entwickelt und vermarktet. Es wird erwartet, dass die Produkte **bereits ab 2025 auf den Markt** kommen
- Obwohl keine Angaben zu Anbau oder Anbauumfang vorliegen, ist davon auszugehen, dass der **Mais mit veränderter Stärke** (*waxy corn*) von *Pioneer (Corteva)* bereits in verschiedenen Ländern auf dem Acker ist. Der Mais hat [Anbauzulassungen](#) in den USA, Kanada, Brasilien, Argentinien, Chile und seit 2023 auch in Japan. Für 2025 plant *Pioneer* verschiedene [Freisetzungsversuche](#) in **Spanien**.
- Ein **herbizidresistenter und Insektengift produzierender Mais (DP915635)** der Firma *Pioneer (Corteva)* hat 2024 eine [Importzulassung](#) (als Lebens- und Futtermittel) in die EU erhalten. Der Mais wurde mittels Transgenese und CRISPR entwickelt. Für einen weiteren (ebenfalls

mittels Transgenese und CRISPR entwickelten) **herbizidresistenten und Insektengift** (Cry1B.34) **produzierenden Mais** von *Pioneer* (DP910521) hat die [EFSA im August 2024](#) einen positiven Bescheid veröffentlicht. Ein Importzulassungsbescheid für die EU liegt noch nicht vor.

- Das US-amerikanische Unternehmen [Benson Hill](#) bietet inzwischen verschiedene (v. a. proteinreiche) **Sojasorten** an, die v. a. speziell für die Tierfütterung geeignet sein sollen.⁵ Die Sorten werden (bis auf die Ausnahme einer herbizidresistenten Sorte) als «Non-GMO» beworben. Das Unternehmen ist aktuell nicht beim [Non-GMO Project](#) gelistet, hat aber, siehe Recherche von Januar 2024, eine Zertifizierung der [Pro Terra Foundation](#). Da *Benson Hill* seit Jahren auch mit [CRISPR](#) arbeitet – sie haben u. a. eigene Nukleasen (mit-)entwickelt und diverse Patente angemeldet – und zu verschiedenen Sojatraits ein [Briefwechsel mit der APHIS](#) vorliegt, ist davon auszugehen, dass zumindest bei einigen der Sorten (ev. erst in Zukunft) auch CRISPR zum Einsatz kommt.

b) Neue gv-Pflanzen im vor-kommerziellen Anbau

Gemäss eigenen Erhebungen gibt es (mind.) 5 Pflanzen, die sich im Stadium des «vor-kommerziellen» Anbaus befinden:

- **Leindotter-Pflanzen mit erhöhtem Ölgehalt** die von *Yield10Bioscience* entwickelt wurden, werden bereits mindestens in den USA angebaut. Weitere Zulassungen liegen für Argentinien (2021), Chile (2022) und [Kanada](#) (2024) vor. **Leindotter-Pflanzen mit einer erhöhten Omega-3-Fettsäure** werden mindestens bereits in den USA und Chile angebaut (*“Initial ramping up of seed production of camelina lines with the trait have begun in US and Chile, with potential for the crop to be grown both as a cash and a cover crop”*). 2024 erhielt das Unternehmen einen (weiteren) [APHIS-Bescheid](#). Die Entwicklung des Omega-3-Traits erfolgte seit 2020 zusammen mit Wissenschaftler*innen des britischen Forschungsinstituts *Rothamsted Research*. 2024 hat Rothamsted *Yield10Bioscience* eine [exklusive weltweite kommerzielle Lizenz](#) für die entsprechende Technologie zur Entwicklung des Omega-3-Traits in Leindotter erteilt. 2024 gab *Yield10Bioscience* bekannt, dass die [Markteinführung des Leindotters in Chile](#) geplant sei. Der Anbau eines **weiteren Omega-3-Leindotter**

5 Weitere Informationen zum gegenwärtigen und zukünftigen Portfolio: <https://www.croplife.com/crop-inputs/seed-biotech/benson-hill-expands-innovation-pipeline-with-advantaged-traits-for-animal-feed-soybean-oil-and-biofuel-segments/>

erfolgt in Zusammenarbeit mit dem Unternehmen [BioMar](#). Im Dezember 2024 hat *Yield10Bioscience* [Konkurs angemeldet](#). Noch ist unklar, wie sich dies auf die vom Unternehmen entwickelten Projekte auswirken wird.

- Das US-Unternehmen *CoverCress Inc.* hat 2024 für sein **Ackerhellerkraut mit erhöhtem Ölgehalt** ein [Farm Adoption Program](#) gestartet.⁶ Das 2-jährige Programm ermöglicht es potentiellen künftigen Anbauern, die Pflanze ohne Risiko in ihrem Betrieb zu testen. Das Unternehmen stellt das Saatgut kostenlos zur Verfügung. Ein Team des Unternehmens arbeitet eng mit den interessierten Landwirten zusammen, indem es ihnen bei der Auswahl der besten Felder für den Anbauversuch hilft, sie über bewährte Verfahren für die Aussaat informiert und den Erfolg der Pflanze in ihrem Betrieb bewertet.
- Für einen **Mais mit erhöhtem Ertrag** hat das chinesische Unternehmen *Origin Agritech Ltd.* 2024 mit der [Saatgutvermehrung](#) begonnen.

c) Neue gv-Pflanzen, die zum Anbau zugelassen wurden

Gemäss eigenen Erhebungen gibt es (mind.) 15 Pflanzen, die eine Anbauzulassung erhalten haben und die sich möglicherweise auch schon im Anbau befinden. Die Datenlage lässt leider keine eindeutigen Angaben zu:

- Zwei **Bananen** mit verschiedenen **non-browning**-Traits haben 2023 und 2024 den Status als [«non-GMO» auf den Philippinen](#) erhalten. Nach Angaben des britischen Unternehmens [TROPIC Bioscience](#), das die Bananen entwickelt hat, können die Pflanze/Früchte *“now be imported and propagated freely in the Philippines”*.⁷
- Eine **besser verdauliche Soja**, die vom brasilianisches Forschungsinstitut *Empresa Brasileira de Pesquisa Agropecuária* (Embrapa) entwickelt wurde, hat bereits 2022 einen Nichtregulierungsbescheid der [Comissão Técnica Nacional de Biossegurança](#) (CTNBio) erhalten. Ob sich diese Pflanze in Brasilien (oder in anderen Ländern) im Anbau befindet, ist unklar.

6 Siehe auch: <https://www.farmprogress.com/cover-crops/here-s-your-chance-to-try-covercress>

7 Siehe auch: <https://emerald.vc/interview-bananas-for-sustainable-agri-tech/>

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- Eine **Soja mit einem verringerten Gehalt an Lecitin** die vom brasilianisches Forschungsinstitut *Empresa Brasileira de Pesquisa Agropecuária* (Embrapa) entwickelt wurde, hat bereits 2022 einen Nichtregulierungsbescheid der [Comissão Técnica Nacional de Biossegurança](#) (CTNBio) erhalten. Ob sich diese Pflanze in Brasilien (oder in anderen Ländern) im Anbau befindet, ist unklar.
- Das weltweit tätige Unternehmen *GDM Seeds* hat 2022 in Brasilien einen Nichtregulierungsbescheid für eine **besser verdauliche Soja** erhalten. Gemäss einer [Reuters-Meldung](#) könnte die Soja 2024/2025 auf den Markt kommen. Ob die Markteinführung inzwischen erfolgt ist, ist unklar.
- Eine **High-Oleic-Soja** des chinesischen Unternehmens [Shandong BellaGen Biotechnology Co.](#) erhielt gemäss [Global Times](#) 2023 ein bis 2028 gültiges «gene editing safety certificate». Ob die Soja inzwischen in China angebaut wird, ist unklar.
- Im [Dezember 2024](#) erhielt eine **Soja mit erhöhtem Ertrag** des chinesischen Unternehmens *Suzhou Qihe Biotechnology Co., Ltd.* (Qi Biodesign) ein «gene editing safety certificate». Ob die Soja bereits in China angebaut wird, ist unklar.
- Im [Dezember 2024](#) erhielt eine **Soja mit verbesserten Eigenschaften** des chinesischen Unternehmens *China Seed Group Co., Ltd.* ein «gene editing safety certificate». Ob die Soja bereits in China angebaut wird, ist unklar.
- Im [Dezember 2024](#) erhielt ein **Mais mit erhöhtem Ertrag** des chinesischen Unternehmens *Weimi Biotechnology (Hainan) Co., Ltd.* ein «gene editing safety certificate». Ob der Mais bereits in China angebaut wird, ist unklar.
- Bereits seit einigen Jahren arbeiten das US-Unternehmen *Corteva* und das *International Maize and Wheat Improvement Center (CIMMYT)* aus Mexiko an der Entwicklung einer **Maissorte, die gegen die Viruserkrankung Maize Lethal Necrosis Disease (MLND) resistent** ist. Erstes Saatgut sollte bereits 2023 (in Afrika) erhältlich sein. Nun heisst es bei [CIMMYT](#): *“By 2025, subject to compliance with regulatory procedures, commercial seeds of the gene-edited MLN-resistant elite maize hybrids will be available to up to 20,000 smallholder farmers for approximately 40,000 hectares of planting.”*
- Ein von *Corteva Agriscience do Brasil Ltda.* entwickelter **pilzresistenter Mais** hat bereits 2023 eine [Anbauzulassung in Brasilien](#) erhalten. Ob der Mais bereits angebaut wird, ist unklar.

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- Ein von der deutschen KWS Saat AG entwickelter **insektenresistenter Mais** hat bereits eine [Anbauzulassung in Brasilien](#) erhalten. Ob der Mais bereits angebaut wird, ist unklar.
- Zwei **Weintraubensorten** von Green Venus (*"Wine grape cultivars that possess natural preservation properties, diminishing or negating the need for sulfites as preservatives during winemaking"*) könnten sich in den [USA bereits im Anbau](#) befinden: "GreenVenus' new Colombard and Malbec grape varieties are currently available for planting to growers and winemakers through licensing agreements." Weitere Sorten sind in Bearbeitung: "the company will complete gene editing on Chardonnay, Sauvignon Blanc, Grenache and Gruner Veltliner later this year and Cabernet Sauvignon, Cabernet Franc, Pinot Noir and Zinfandel by this time next year."
- Im Mai 2024 hat ein **mehltauresistenter Weizen** des chinesischen Unternehmens [Suzhou Qihe Biotechnology Co., Ltd.](#) (Qi Biodesign) ein [«gene editing safety certificate»](#) erhalten.⁸ Ob sich der Weizen bereits im Anbau befindet, ist unklar.
- Im [Dezember 2024](#) erhielt ein **herbizidresistenter Weizen** des chinesischen Unternehmens [Suzhou Qihe Biotechnology Co., Ltd.](#) (Qi Biodesign) ein «gene editing safety certificate». Ob sich der Weizen bereits im Anbau befindet, ist unklar.

d) Neue gv-Pflanzen, deren Markteinführung – gemäss Angaben der entwickelnden Unternehmen – in den nächsten Jahren geplant ist.

Gemäss eigenen Erhebungen ist für (mind.) 22 Pflanzen die Markteinführung in den nächsten Jahren geplant:

- Das US-amerikanische Unternehmen *Amfora* vermarktet bereits konventionell gezüchtete **Sojasorten** (u. a. mit einem **erhöhten Ölgehalt**). In den nächsten Jahren sollen [mittels CRISPR verbesserte Sorten](#) folgen.
- Das US-Unternehmen *Inari* arbeitet an verschiedenen Soja-Traits, darunter **Soja mit erhöhtem Ertrag**. Gemäss [eigenen Angaben](#) ist Inari "readying itself for commercialization with this latest funding round. Initial markets include the US, Canada and Australia. For now, the company will stick to row crops: soybeans, corn and wheat, with soybeans first to market in the US." Für einen **Mais mit verkürzter Stängellänge** liegt ein Nichtregulierungsbescheid der APHIS vor und es fanden [2023](#) und [2024 Freisetzungsversuche in Belgien](#) statt.

8 Siehe auch: <https://www.isaaa.org/kc/cropbiotechupdate/ged/article/default.asp?ID=20821>

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- Das weltweit tätige Unternehmen *GDM Seeds* hat 2022 in Brasilien einen Nichtregulierungsbescheid für eine **trockentolerante Soja** erhalten. Gemäss einer [Reuters-Meldung](#) könnte die Soja 2026/2027 auf den Markt kommen.
- Das argentinische Unternehmen *BioHeuris* arbeitet an verschiedenen **herbizidresistenten Kulturen**, darunter **Soja, Baumwolle, Sorghum** und **Reis**. Nach [Unternehmensangaben](#) werden einige der Traits "already being tested in rice and sorghum fields in Brazil and the United States. While not yet in the commercial phase, they have passed technical and regulatory challenges. We obtained approval from CONABIA (*National Advisory Commission for Agricultural Biotechnology*) in Argentina and similar approvals in countries like the United States, Brazil, Chile, and Colombia. BioHeuris projects these **rice and sorghum varieties** will be available in the market by 2026 or 2027."
- Für den von der [INSIGNIUM AgTech](#) (USA) entwickelten **Mais, der bei Krankheitsbefall spezifische Verfärbungen der Blätter** zeigt (*Production of Anthocyanin in response to pathogen infection*) liegen zwei [APHIS-Bescheide](#) (2023, 2024) vor. Der Mais befindet sich seit mindestens [zwei Jahren im Freisetzungsversuch](#) in den USA. Zur Markteinführung gibt es noch keine genaueren Angaben.
- Das US-Unternehmen *Corteva* plant, einen **Kurzstängelmais** ca. [2027 auf den Markt](#) zu bringen.
- Das US-Unternehmen *Corteva* plant, einen **gegen vier verschiedene Krankheiten resistenten Mais** [ca. 2028 auf den Markt](#) zu bringen.
- Das US-Unternehmen *Cibus*, das zuletzt wegen dem Vorwurf der Investorentäuschung unter Druck stand (siehe unten), gibt für seinen **herbizidresistenten Reis** (es sind verschiedene Traits in Entwicklung) [Fortschritte bekannt](#): "Cibus expects to have field scale demonstrations of the HT rice traits in the US Mid-South in 2024 and expand to other geographies in 2025".
- Gemäss der [Kanadischen List of non-novel products of plant breeding for food use](#) sind zwei vom US-Unternehmen *Simplot Plant Sciences* entwickelte **Kartoffelsorten** (Sorte I: **erhöhter Ertrag**/erhöhte Knollenbildung, Markteinführung 2024, Sorte II: **reduzierter Gehalt an Glykoalkaloiden (u. a. Solanin) und Resistenz gegen Schwarzfleckigkeit**, Markteinführung 2025) sowie eine **Erdbeersorte (mehr Ertrag durch 2x Blüte-/Fruchtbildung**, Markteinführung 2025) bereits auf dem Markt oder stehen kurz vor der Markteinführung.
- Die Markteinführung von einem **Süssstoff**, der aus mittels **Genome-Editing veränderten (Wasser-)Melonen** gewonnen wird, soll gemäss *Elo Life Sciences* [2026](#) erfolgen.

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- Das US-Unternehmen *Pairwise* meldete 2024 einen [Durchbruch](#) bei der Entwicklung **kernloser Brombeeren**: "We're excited to advance these berries into the next phase of product development, including outdoor field trials, as we work toward scaling up and making them available to the public in a few years."⁹
- Eine von *Calyxt* (das Unternehmen wurde 2023 von *Cibus* übernommen) mittels TALEN entwickelte **Luzerne mit reduziertem Lignin-Gehalt** (zur besseren Verdaulichkeit) soll «demnächst» von der [S&W Seed Company](#) (an die *Calyxt* den Trait lizenziert hat) auf den Markt gebracht werden. Auf der Seite von S&W heisst es: «Unsere künftigen Luzerne-Sorten werden bald IQA™ enthalten, ein durch Gen-Editierung erreichtes Qualitätsmerkmal für Luzerne mit reduziertem Lignin. Es wird in das Keimplasma von Elite-Luzerne integriert, um sowohl den Ertrag als auch die Futterqualität zu verbessern. Die Landwirte haben die Flexibilität, später zu ernten, ohne dass die Futterqualität wie bei herkömmlichen Sorten abnimmt, oder sie können nach ihrem normalen Zeitplan ernten, um potenziell eine höhere RFQ und eine Luzerne mit geringerem Lignin zu erhalten. Dies kann ein erweitertes Erntefenster mit verbesserter Futterqualität bieten. Bitte erkundigen Sie sich bei Alfalfa Partners nach der Verfügbarkeit in Ihrer Region und danach, ob ihr spezifisches Anbauumfeld für eine gentechnisch veränderte Sorte empfindlich sein könnte.» Dieser Hinweis steht bereits seit Ende 2022 auf der Seite von *S&W Seed*. Neu ist nur die Meldung, dass der Vertrieb über [Alfalfa Partners](#) erfolgen soll.
- Ein vom US-Unternehmen *Inari* entwickelter **Weizen mit erhöhtem Ertrag** soll ab 2025 in Freisetzungsvorversuchen in Australien getestet werden: Das australische Unternehmen [InterGrain](#) hat Anfang 2024 Weizensaatgut verschiedener Zuchtlinien importiert, die vom amerikanischen Biotechunternehmen *Inari* mittels CRISPR/Cas verändert wurden und Hunderte neuer genetischer Varianten enthalten. Diese Linien wachsen nun in einem Versuchsgewächshaus im Südosten Queenslands heran. Aus dem Anbau dieser Pflanzen wird Saatgut gewonnen, damit in der Anbausaison 2025 genügend Saatgut für mehr als 45 Versuchsstandorte im ganzen Land zur Verfügung steht.¹⁰
- Zwei **Zuckerrohrsorten** (**Canaflex I: Bessere Verdaulichkeit, Canaflex II: Erhöhter Saccharosegehalt**), die vom brasilianischen Forschungsinstitut *Empresa Brasileira de Pesquisa Agropecuária* (Embrapa, Agroenergia) entwickelt wurden, haben bereits 2021 einen

9 Siehe auch: <https://www.isaaa.org/kc/cropbiotechupdate/ged/article/default.asp?ID=20879>

10 Siehe auch: <https://www.reuters.com/markets/commodities/australian-trial-gene-edited-wheat-aims-10-bigger-yields-2024-05-23/>

Nichtregulierungsbescheid der [Comissão Técnica Nacional de Biossegurança](#) (CTNBio) erhalten. Über den Anbau oder die Markteinführung dieser Sorten liegen keine Daten vor.

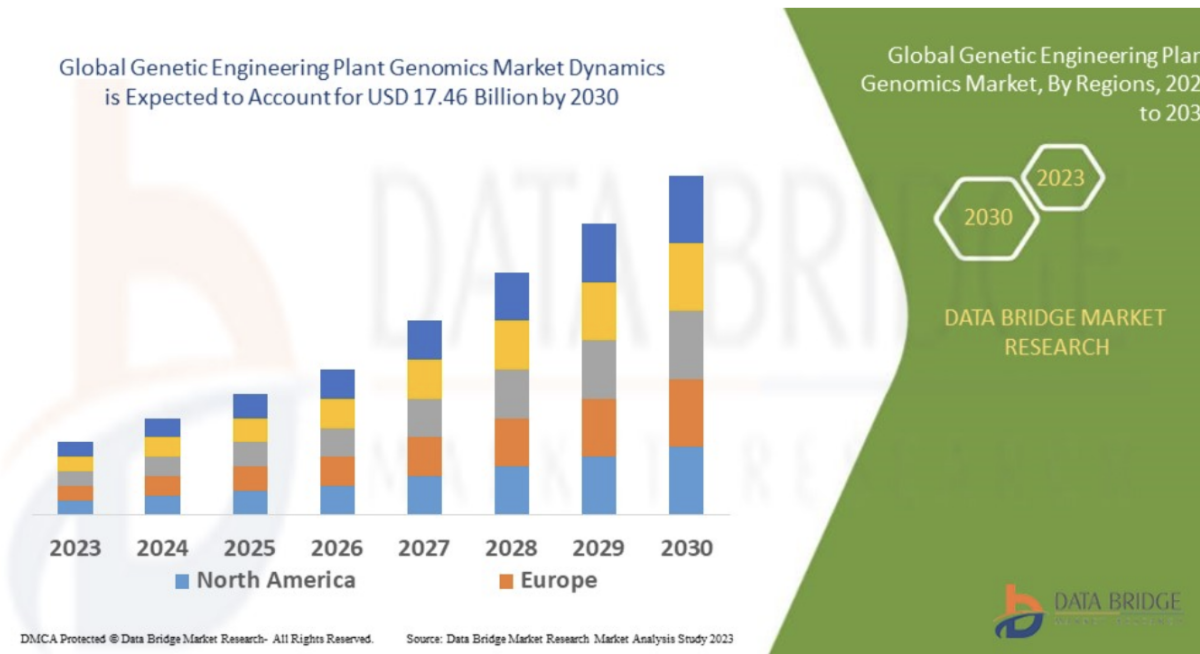
- Das US-Unternehmen *Ohalo Genetics Inc.* hat mittels CRISPR eine «**verbesserte**» (*improved agronomic property*) **Mandelsorte** entwickelt. 2024 hat das Unternehmen einen positiven APHIS-Bescheid erhalten. Das [Unternehmen schreibt](#): "After four years of dedicated research and development, Ohalo is proud to announce completion of its USDA Regulatory Status Review process for FruitionOne with availability for early orders in late 2026 and first commercial deliveries beginning in 2027. The first FruitionOne trial orchard plantings are underway in California."

2. Weitere Übersichten/Quellen zur Produktpipeline/Marktentwicklung

Marktübersichten

Frei zugängliche (kostenlose) Marktübersichten gibt es nicht. Eine Analyse von [Data Bridge Market Research](#) (*Global Genetic Engineering Plant Genomics Market – Industry Trends and Forecast to 2030*) soll zeigen, dass sich der Sektor auf einem kräftigen Wachstumspfad befindet. Von 9,04 Mrd. USD im Jahr 2022 soll der Markt mit einer jährlichen Rate (CAGR) von 8,7 % weiter wachsen. Bis 2030 wird eine Marktbewertung von 17,46 Mrd. USD prognostiziert.

Ein Bericht von [Statista](#) schätzt, dass der Markt für CRISPR-Cas-Gene-Editing im Pflanzenbereich von 2,4 Mrd. USD im Jahr 2023 auf rund 33 Mrd. USD im Jahr 2033 ansteigen wird.



3. Ergänzende Informationen zu einzelnen Unternehmen

a) CIBUS

Ermittlungen gegen das Unternehmen Cibus wegen Täuschung von Investoren

Gegen das Unternehmen *Cibus Inc.*, das es erst vor wenigen Monaten auf die [Liste](#) der "World's Most Innovative Companies of 2024" [geschafft hat](#), wird nun von einer Reihe von [US-Anwaltskanzleien](#)¹¹ wegen Täuschung von Investoren ermittelt. Vorausgegangen war dem ein Forschungsbericht für Investoren, in dem behauptet wurde, sie seien von den Versprechen des Unternehmens über seine Gen-Editierungs-Technologie getäuscht worden.

Cibus [bezeichnete](#) sich nach der Fusion mit *Calyxt* (2023) als «branchenführendes Unternehmen für Präzisions-Gen-Editierung» und [behauptete](#), dass Kulturpflanzen, für deren Herstellung die herkömmliche Gentechnik 15 Jahre und enorme Kosten benötigte, von *Cibus* in nur drei Jahren zu einem Bruchteil der Kosten entwickelt werden könnten. Zu den [Kunden von Cibus](#) sollen daher Branchenriesen wie *Bayer*, *Nutrien* und *Procter & Gamble* gehören.

Diese Versprechen wurde jedoch ernsthaft in Zweifel gezogen, als ein Unternehmen namens *Bonitas Research* einen Bericht herausgab,¹² in dem es heisst, dass es «keine Beweise dafür gefunden hat, dass die Gen-Editing-Technologie von Cibus wünschenswerte neue Nutzpflanzen auf den Markt bringt». Was *Bonitas* jedoch nachweisen konnte, waren Beschwerden von Landwirten über geringere Ernteerträge und Einkommensverluste sowie mehrere Beispiele von grossen Saatgutherstellern und -händlern, die Joint Ventures und Partnerschaften mit Cibus für eine Vielzahl von

11 Siehe auch: <https://www.johnsonfistel.com/investigations/cibus-inc>, <https://www.businesswire.com/news/home/20240605581184/en/Glancy-Prongay-Murray-LLP-a-Leading-Securities-Fraud-Law-Firm-Announces-Investigation-of-Cibus-Inc.-CBUS-on-Behalf-of-Investors>, <https://www.einpresswire.com/article/717539600/investigation-into-cibus-inc-cbus-announced-by-holzer-holzer-llc>

12 Bonitas Research (2024). Cibus Inc. https://www.bonitasresearch.com/wp-content/uploads/dlm_uploads/2024/06/BonitasResearch-Short-Cibus-Nasdaq-CBUS-June-4-2024.pdf

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Saatguttypen und Saatguteigenschaften aufgekündigt haben. [Block & Leviton](#) gehört zu den US-amerikanischen Anwaltskanzleien, die erklärt haben, dass sie «diese Anschuldigungen untersuchen».

Der herbizidresistente Raps von *Cibus*, der nach seiner Zulassung 2014 in Nordamerika auf den Markt gebracht wurde, war bereits [2022 spurlos vom Markt verschwunden](#). Das Vorzeigeprodukt des Unternehmens, das als [«Durchbruch»](#) angepriesen wurde und das die Fähigkeit des Gen-Editierens demonstrieren sollte, Landwirten «deutliche, nachhaltige Vorteile für ihre Ernten» zu bieten, war gescheitert. Das Ergebnis bestätigte die Ansicht der Skeptiker, dass es sich bei Gene Editing um eine überbewertete Technologie handelt, die ihre Versprechen nicht einhalten wird.

Ein weiterer Fehlschlag: gen-editierte Sojabohnen

Durch die Fusion mit *Calyxt* erbte *Cibus* auch die mittels TALEN veränderte Sojabohne «Calyno» mit hohem Ölsäuregehalt. Doch genau wie der Raps von *Cibus* scheiterte auch diese Pflanze auf dem Markt. Tiefe Ernteerträge führten zu einer geringen Akzeptanz bei den Landwirten, und *Calyxt* geriet in finanzielle Schwierigkeiten, was zur Fusion mit *Cibus* führte.

Das Investmentmagazin [Seeking Alpha](#) kam 2020 zu dem Schluss: «Die erste gen-editierte Kulturpflanze, die in den Vereinigten Staaten vermarktet wird, ist ein Flop» was die Befürworter von GVO jedoch nicht davon abhält, die Soja weiterhin als Erfolg darzustellen. Ein vom *Institute of Economic Affairs* im Dezember 2022 veröffentlichtes Diskussionspapier mit dem Titel [Harvest time: Why the UK should unleash the power of gene editing](#) nennt die *Calyxt*-Sojabohne ein Schlüsselbeispiel dafür, wie «Länder, die ihre Vorschriften für das Gen-Editing von Kulturpflanzen liberalisiert haben, beginnen, die Vorteile zu erkennen, die diese leistungsstarke Technologie freisetzen kann». Auch ein Leitfaden der britischen *National Farmers Union* mit dem Titel [What you need to know about gene editing in agriculture](#), der im Januar 2024 aktualisiert wurde, verweist auf die jetzt im Besitz von *Cibus* befindliche *Calyno*-Sojabohne als eines von nur zwei Beispielen für zugelassene Gen-Editing-Pflanzen, die derzeit in der Landwirtschaft verwendet werden.

Geschichte des Scheiterns

Bonitas fasst die Geschichte des Scheiterns von *Cibus* wie folgt zusammen:

- Gescheiterte Produkteinführungen und gescheiterte Partnerschaften mit geringen/keinen Einnahmen.

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- Für die für 2025 geplante Markteinführung der Rapseigenschaft «erhöhte Schotenplatzfestigkeit» besteht bereits ein harter Wettbewerb.
- 250 Millionen US-Dollar Überzahlung an Insider für Vermögenswerte: Zum Zeitpunkt der Fusion im Jahr 2023 wurde die Technologie von *Cibus* mit einem Firmenwert und immateriellen F&E-Vermögenswerten in Höhe von 750 Millionen US-Dollar bewertet, doch im ersten Jahr als börsennotiertes Unternehmen schrieb *Cibus* den Buchwert seiner immateriellen Vermögenswerte unerwartet um 250 Millionen US-Dollar ab. Wenn die Technologie von *Cibus* so gut ist, warum wurden dann 33% des Wertes seiner F&E- und Trait-Pipeline innerhalb des ersten Jahres als börsennotiertes Unternehmen abgeschrieben?
- «Vorsitzender beschuldigt, Investoren in die Irre geführt zu haben: Der Vorstandsvorsitzende und CEO von *Cibus*, Rory B. Riggs ("Riggs"), ist in der Vergangenheit als Beklagter in mehreren Prozessen wegen Insiderhandels, ungerechtfertigter Bereicherung, Irreführung von Anlegern und Verletzung von Treuepflichten aufgeführt worden. Wir glauben, dass Riggs wieder seine alten Tricks anwendet, um Cibus-Aktien zu pumpen. Zusätzlich zu den verpfändeten CBUS [Cibus]-Aktien für persönliche Schulden hat Riggs im März 2024 eine Handelsvereinbarung getroffen, um bis zum 12. Juli 2024 bis zu 300.000 Aktien zu verkaufen.»

Investoren «betrogen»

Bonitas schlussfolgert: "We think investors have been duped into believing a promotional management team about an over-hyped technology previously tried, tested, and failed by some of the world's largest seed manufacturers and distributors to provide exit liquidity for early-stage Cibus investors. As of 1Q'24 [first quarter of 2024], Cibus burned ~US\$ 5 million in cash per month and generated less than ~US\$ 200,000 in monthly revenues. With less than ~US\$ 24 million in cash as of March 31, 2024, we calculate that CBUS will need to either generate significant revenues or raise capital to satisfy ongoing operating expenses by September 2024. With little/no revenues from its technology, we are short CBUS and think that its stock is going significantly lower towards 'zero'."¹³

13 Quelle: [GM Watch: GMO company Cibus investigated for deceiving investors](#)

Cibus veröffentlicht Fülle an Medienmitteilungen zu F&E-Projekten

Die laufenden Untersuchungen gegen *Cibus Inc.* sind vermutlich der Hintergrund, warum das Unternehmen bemüht ist, zu einzelnen seiner Projekte eindeutige Erfolge zu vermelden. Im Jahr 2024 gab es hierzu auffällig viele Medienmitteilungen:

- Januar 2024: [Cibus Announces Major Breakthrough in Wheat Regeneration from Single Cells](#)
- Januar 2024: [Cibus 2023 Field Trial Results Move Developed Traits Closer to Product Sales](#)
- Mai 2024: [Cibus' White Mold \(Sclerotinia\) Resistance Trait Program Confirms Important Milestone for Next Generation Gene Edits in Canola](#)
- Juni 2024: [Cibus Confirms Important Milestone for Nutrient Use Efficiency Trait Development](#)
- Juni 2024: [Cibus Expands its Intellectual Property Coverage for Plant Gene Editing and Traits](#)
- August 2024: [Cibus Achieves Positive Initial Field Trial Results for Stacked Gene Edited Herbicide Tolerant Traits in Rice](#)
- September 2024: [Cibus Completes First Field Trials in UK for Pod Shatter Reduction in Winter Oilseed Rape](#)
- November 2024: [Cibus Confirms its Herbicide Tolerance \(HT2\) Trait Shows Increased Tolerance to a Novel Herbicide for Weed Control in Canola](#)
- November 2024: [Cibus Achieves Additional Milestone for Next Generation Gene Edits for Sclerotinia Resistance in Canola](#)

b) Corteva



Produktpipeline

Ein Blick in die Investoren-Präsentationen der führenden Saatgut- und Chemieunternehmen (Corteva, Bayer (siehe unten), BASF und Syngenta) zeigt, dass deren Hauptgeschäft nach wie vor in der Entwicklung mehrfach gestackter, transgener Pflanzen und in der Entwicklung von Agrarchemie (Herbizide, Fungizide, Insektizide, neu auch «Biologicals») besteht (siehe auch die [Recherche von 2024](#)).

In einer Übersicht des Newsportals DTN ([Seed and Trait Companies Reveal What's Coming to the Field. Trait Pipeline Preview](#)), das die Produkte und Traits aufführt, die ab 2025 auf den Markt kommen sollen, wird für BASF, Bayer, Corteva und Syngenta keine einzige mittels Genome Editing entwickelte Pflanze erwähnt.

In einer [Investoren-Präsentation von Corteva](#) erscheint «Gene Editing» (*The Future of Plant Breeding*) in der Rubrik «Investing in Long-Term, Multi-Year Growth Platforms» neben den Bereichen «Biofuels» und «Hybrid Wheat»:

Investing in Long-Term, Multi-Year Growth Platforms

 Gene Editing	 Biofuels	 Hybrid Wheat
1,400+ Unique Gene Targets Edited, 300+ Edits Field Tested	Delivering Value in Frontier Double Cropping System	Driven by New Proprietary Sterility System
The Future of Plant Breeding and Product Development	Demand for NextGen Biofuels Expected to Reach ~ 10B Gallons by 2030 ²	10% Yield Advantage Potential, with Up to 20% Under Stress ⁴
USDA-APHIS Regulatory Authorization for Corn MDR ¹	100M+ of Potential Global Acres for Double Cropping Systems ³	~ 550M Acres of Wheat Planted Globally Each Year ⁵
Unlocking Multi-Billion Dollar Revenue Opportunities in Next Decade		



¹ Multi-disease resistance corn.
² IEA (2024). Renewables 2024, IEA, Paris.
³ Corteva Internal Analysis.
⁴ Internal yield trial testing: 2 years of testing with 6-10 locations/year in each of the market classes. HRW testing in NE, KS, CO, OK.
⁵ FAO. Global wheat area harvested in 2022.

Zwei gen-editierte Maispflanzen befinden sich laut Corteva in der Kommerzialisierungspipeline für die nächsten Jahre:

Building on Record Corn Performance with NextGen Proprietary Traits

Reduced Stature Corn (NA)



LAUNCH 2027

With **PowerCore® Enlist®** traits
Standability with **increased yield potential** and strong **resistance** to extreme weather events

Testing at Scale

Gene Edited Disease Resistance (NA)



LAUNCH 2028

Gene editing-enabled with resistance to **four key diseases**
Brings **yield protection** while enabling increased **yield potential**

Optimizing Deployment

3rd Gen. Above Ground (LA)



LAUNCH 2029

Extends fall army worm control providing **excellent protection**
Delivers a **first-in-kind trait** to enhance and **stabilize yield**

Conversions & Regulatory

Reduced Stature Corn – Accelerating Yield Improvement

Corteva Advantage

Delivering Resilience and Optionality

- **Dominant native gene for reduced stature** is the base for a generational product line
- Delivered in our **industry-leading, traited germplasm**
- Providing **consistent plant height reduction** and **ear height** for all growing conditions tested
- Consistency **enables over the top equipment application** options
- Works with farmers equipment
- **Improved standability** vs. non-RSC corn



LAUNCHING 2027

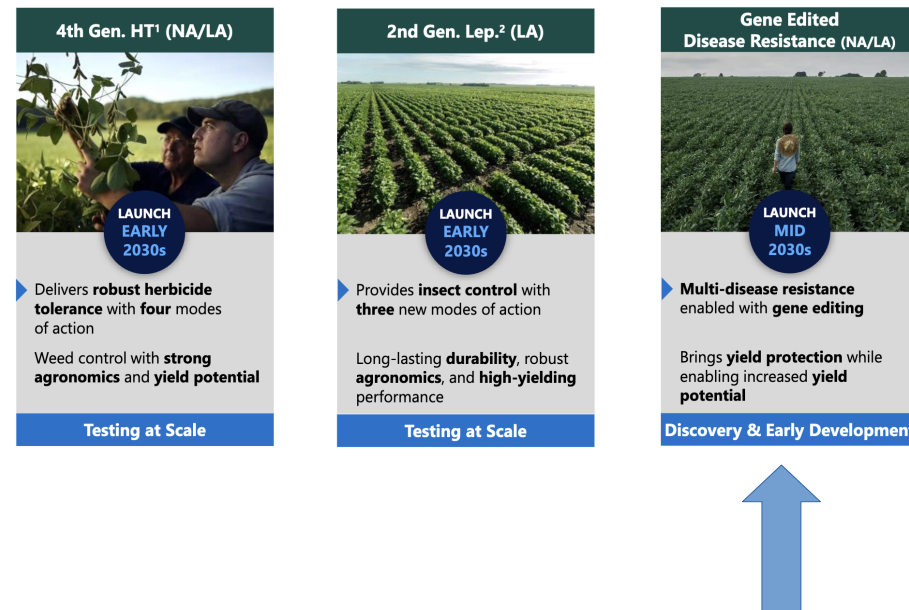
Building on our Advantage

Unlocking Value through Yield Improvement

- Building additional yield on a new stable, lodging resistant foundation
- Higher plant density, to **accelerate gains in yield per acre**
- Building on reduced stature platform with **gene editing to expand potential**
- Enhanced by **decision science** through **Granular Insights** for field- and hybrid-specific seeding and crop protection prescriptions

Weitere gen-editierte Maispflanzen kündigt Corteva für die Zeit ab Mitte der 2030er Jahre an:

Building on Record Soybean Performance with NextGen Proprietary Traits



Investition in und Zusammenarbeit mit Pairwise

2024 lancierte Corteva eine neue Investitionsplattform ([Corteva Catalyst](#)). Das erste Projekt ist eine auf 5 Jahre angelegte Zusammenarbeit (*Joint Venture*) mit *Pairwise*. Darüber hinaus investiert Corteva 25 Millionen USD in *Pairwise*. Die Investition soll dazu beitragen, die Reichweite und die Vorteile des Gene Editing auf eine Vielzahl von Grundnahrungsmitteln und Spezialkulturen auszuweiten: [Corteva, Pairwise Join Forces to Accelerate Gene Editing, Advance Climate Resilience in Agriculture](#).



Weitere Zusammenarbeit mit Bayer

Im [Mai 2024](#) gab *Pairwise* bekannt, dass das Unternehmen eine (weitere) exklusive Lizenzvereinbarung mit *Bayer* abgeschlossen hat. Die Vereinbarung sieht vor, dass *Bayer*, aufbauend auf dem von *Pairwise* entwickelten Senf mit reduzierten Bitterstoffen, zehn weitere Genom-editierte (Senf-)Salate entwickelt und vermarktet. Es wird erwartet, dass die Produkte bereits ab 2025 auf den Markt kommen. *Bayer* hat angedeutet, dass nach der Markteinführung in den USA auch andere Märkte erschlossen werden sollen.

Es wurden bislang keine Informationen über die Zusammensetzung oder den Markennamen dieser zehn Produkte veröffentlicht, aber es ist möglich, dass *Bayer* die Salate unter einer oder mehrerer neuer Marken und nicht unter der ursprünglichen, von *Pairwise* eingeführten Marke *Conscious™ Greens* vermarkten wird. Der Umfang des Anbaunetzes und die Standorte der Anbauer sind ebenfalls unbekannt.¹⁴

Im [September](#) gab *Pairwise* bekannt, dass das Unternehmen kürzlich eine Finanzierungsrunde der Serie C in Höhe von 40 Millionen Dollar abgeschlossen hat. Einer der Hauptinvestoren war [Leaps by Bayer](#), der strategische Investmentarm von *Bayer*.

Unternehmensentwicklung und Produktpipeline

Pairwise arbeitet nach eigenen Angaben an einem Mais mit einer um mehr als 20 % höheren Anzahl von Körnerreihen/Kolben, was zu einem deutlich höheren Ertrag pro Hektar führen könnte.¹⁵ Normalerweise hat Mais etwa 16 Reihen von Körnern pro Kolben, aber es gibt ein Gen, das den Maisgenetikern schon lange bekannt ist. Wenn man dieses Gen ausschaltet, verliert die Pflanze die Kontrolle über die Anzahl der Reihen von

14 Quelle: <https://www.nongmoproject.org/blog/new-gmo-alert-navigating-gmos-in-the-produce-section/>

15 Alle Angaben in diesem Abschnitt stammen aus einem Interview mit dem *Pairwise*-CEO Tom Adams (Juni 2024): <https://agfundernews.com/crispr-and-the-new-era-of-precision-plant-breeding-in-conversation-with-pairwise-ceo-dr-tom-adams>

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Körnern, die gebildet werden. *Pairwise* verwendet die Base-Editing-Technologie, um eine einzelne Aminosäure gezielt zu verändern, und kann so Maispflanzen mit Kolben erzeugen, die 18, 20, 22 oder sogar 24 Reihen haben.¹⁶

Pairwise arbeitet auch an «kernlosen» Kirschen und Brombeeren, bei denen das harte Gewebe um den Kern entfernt wurde, so dass der Kern weniger hart und störend ist (wie bei «kernlosen» Weintrauben). *Pairwise* hat weitere Brombeer-Phänotypen entwickelt. Zum einen wurden die Dornen entfernt, zum anderen wurde die Architektur der Pflanze so verändert, dass sie eine kompaktere Struktur aufweist. Der Ertrag pro Pflanze ist vielleicht etwas geringer, aber man kann dreimal so viele Pflanzen auf derselben Fläche unterbringen, so dass der Ertrag erheblich gesteigert werden kann. Der Phänotyp des kompakten Wachstums wird bereits in einigen Gewächshausversuchen getestet und das Unternehmen erwartet, dass die Pflanzen 2025 in Feldversuchen geprüft werden können. Beeren benötigen, um zu blühen und Früchte anzusetzen, normalerweise eine Kälteperiode. Bei den von *Pairwise* entwickelten Beeren ist das nicht der Fall, so dass sie auch in einem wärmeren Winter noch Früchte tragen können. Darüber hinaus arbeitet *Pairwise* an einer schwarzen Himbeere, die in Nordamerika eigentlich heimisch ist. Sie ist nahrhafter als rote Himbeeren, hat aber grosse Samen und einige Probleme bei der Domestizierung. Daher versucht das Unternehmen, sie mithilfe von CRISPR so zu verändern, dass sie eher einer roten Himbeere ähnelt.

Pflanzen verfügen über einen gewissen natürlichen Insektenschutz, der sich vielleicht durch Gen-Editing ausnutzen lässt. Die Insektengiftigkeit, z. B. die Fähigkeit, Bt-Proteine zu produzieren, lässt sich laut *Pairwise* derzeit allerdings immer noch besser mittels Transgentechnik entwickeln. Eigenschaften wie Trockentoleranz und Pflanzen, die mit einem hohem Salzgehalt im Boden zurechtkommen, sollen – so *Pairwise* – nur schwer mittels Genome Editing zu entwickeln sein.

16 An diesem Maistrait arbeiten auch andere Unternehmen, u. a. *Inari*.

d) Yield10 Bioscience



Im Juli 2024 gaben *Yield10Bioscience* und *Nuseed (Nufarm)* bekannt: "Nufarm and Yield10 have additionally agreed to immediately negotiate exclusively with each other for the sale of Yield10's remaining assets to Nufarm. The asset sale will require an affirmative vote from the shareholders of Yield10, and a special meeting of shareholders will be convened to seek that vote following execution of the asset purchase agreement."

Am 8. November 2024 kündigte *Yield10Bioscience* an, dass die für den selben Tag geplante ausserordentliche Aktionärsversammlung vertagt wurde, da nicht genügend Stimmen für die Hauptanträge im Zusammenhang mit dem Verkauf von Vermögenswerten an *Nuseed* und dem Auflösungsantrag abgegeben wurden.¹⁷

Am 6. Dezember 2024 beantragte *Yield10Bioscience* ein Konkursverfahren,¹⁸ dem am 9. Dezember stattgegeben wurde.¹⁹

17 <https://www.accessnewswire.com/newsroom/en/computers-technology-and-internet/yield10-bioscience-announces-adjournment-of-special-meeting-of-sto-940250>

18 <https://www.publicnow.com/view/73C5666774C693BC14B4436056ED4E04CFB0AE60?1733525211>

19 <https://ca.marketscreener.com/quote/stock/YIELD10-BIOSCIENCE-INC-39016366/news/Motion-for-Joint-Administration-Approved-for-Yield10-Bioscience-Inc-48611206/>

e) Bayer CropScience



Im [Mai 2024](#) gab Bayer bekannt, dass das Unternehmen mit dem südkoreanischen Biotech-Unternehmen G+FLAS zusammenarbeiten will, um mittels Genomeditierung Tomatensorten zu entwickeln, die mit Vitamin D3 angereichert sind. Als Teil der Vereinbarung ist geplant, mit Genomeditierung Saatgut für weitere Tomatenprodukte zu entwickeln.

Darüber hinaus meldete Bayer, dass das Unternehmen eine neue [Open-Innovation-Plattform](#) mit Fokus auf Genomeditierung in Obst und Gemüse gestartet hat. Das Unternehmen sucht Partnerschaften mit akademischen Forschern und Unternehmen, um gemeinsam neue Obst- und Gemüseprodukte zu entwickeln.

In einem Beitrag mit dem Titel [The promise CRISPR holds to revolutionize our world](#) gibt sich das Unternehmen im Hinblick auf die Möglichkeiten der Technologie(n) im Pflanzenbereich eher zurückhaltend: "And although CRISPR can help solve some of the biggest challenges, it's important to be realistic in our promises to the public. Scientists are still in the earliest stages of figuring out how we can make use of gene-editing tools like CRISPR to change the world for the better. A lot of progress still has to be made. And finally, although gene editing is a powerful tool, it's not a cure-all."

Unter den [zehn «Blockbustern»](#), die Bayer in den nächsten zehn Jahren lancieren will, befindet sich nur ein Genome-Editing-Projekt: ein Kurzstängelmais, der im Rahmen des neuen [Preceon Smart Corn](#)-Programms vermarktet werden soll. (Erste konventionell entwickelte Kurzstängelmaissorten dieses Programms sind bereits auf dem Markt, für 2027 ist die Einführung transgener Sorten (zusammen mit BASF) angekündigt. Die Genome-Editing-Sorten entstehen in Zusammenarbeit mit Pairwise. Zu den verschiedenen Kurzstängelmais-Projekten von Bayer, Corteva, Inari und Stine Seeds siehe auch die [Recherche von 2024](#)).

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In einer Investorenpräsentation von November 2024, in der einige der zehn «Blockbuster» präsentiert werden, befindet sich keine mittels Genome Editing entwickelte Pflanze:



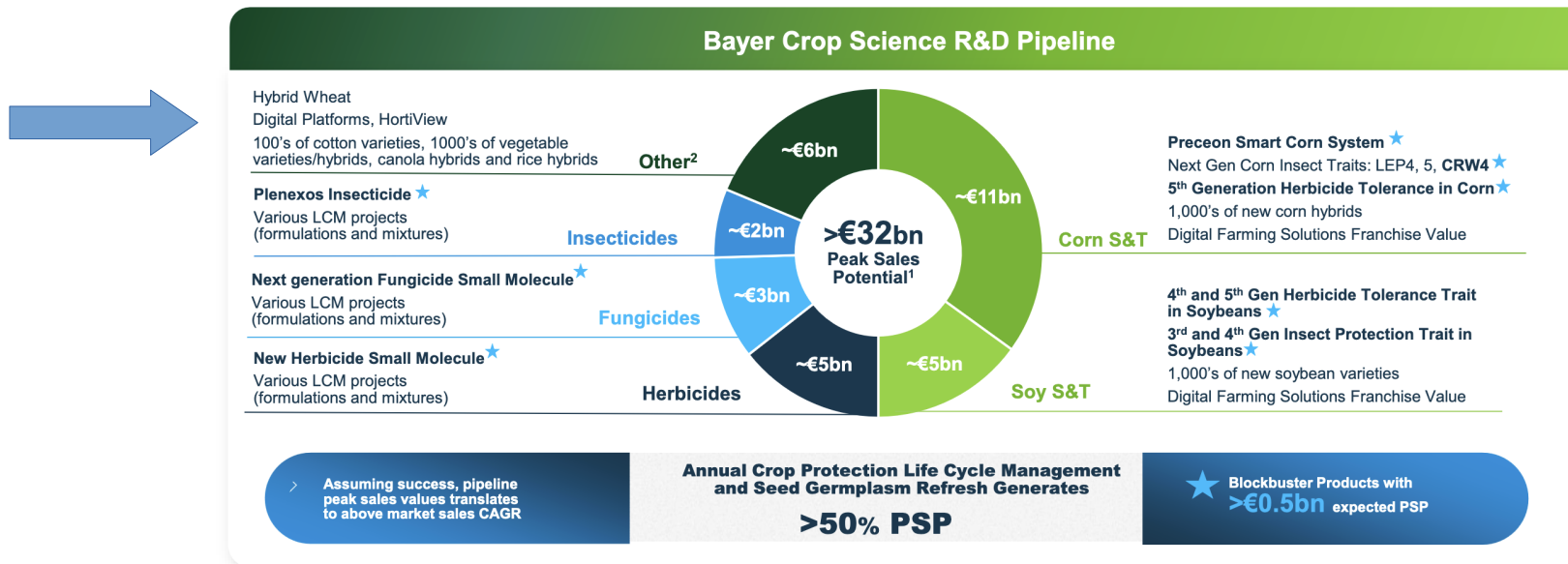
Die geplante Vitamin-D-Tomate ist Teil des Produktsegments «Verschiedenes»:

Crop Science



Extending Our Leadership Position Through Our Pipeline

>€32bn Peak Sales Potential; Ten Blockbusters Expected to Launch in Next Decade



¹ Represents non-risk adjusted estimated peak sales for the combined breeding, biotech, crop protection and environmental science pipelines, as well as new business models and new value areas. On average, ~50% of the PSP is incremental and 50% is replacement value. Note that products are excluded from the pipeline PSP typically the year following launch. Projects listed are only a subset of the pipeline. Direct-seeded rice, carbon farming, corn biotech traits in Asia and Africa and ~1.5bn EUR sales ambition in biologicals are upside potential to the €32bn PSP.

² Other² category includes seeds and traits, such as cotton, canola, wheat, OSR, rice, vegetable seeds and sugarbeets, plus digital platforms and SeedGrowth

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

(UPDATE Stand: Januar 2025, Neue Einträge sind unterstrichen)

Kultur	Verfahren ^{a)}	Eigenschaften	Unternehmen ^{b)}	Entwicklungs- status ^{c)}	Freisetzungs- versuche
Raps	Rapid Trait Development System (RTDS™), <u>ODM</u>	Herbizidresistenz	Cibus Inc. (USA) ¹	APHIS-Bescheid 2020 <u>November 2024: Cibus "announced that its next generation edits for herbicide tolerance (HT2) in Canola have shown increased tolerance to the herbicide in greenhouse testing. With the achievement of this milestone, seed from these edited plants will be utilized to initiate larger scale field testing in the 2025 season. Reaching this critical milestone is another demonstration of complex editing in Canola by Cibus leading to improved trait performance."</u> ²	Ja Gewächshausversuche und 1 Jahr Freiland ³ <u>Larger scale field testing in the 2025 season</u>

¹ <https://www.cibus.com/> Gelb markierte Unternehmensnamen: Zusatzinformationen in der Einleitung.

² <https://investor.cibus.com/node/9901/pdf>

³ <https://investor.cibus.com/static-files/8300dee4-2176-4a17-b9a1-5fdbcd292564>

Kultur	Verfahren ^{a)}	Eigenschaften	Unternehmen ^{b)}	Entwicklungs- status ^{c)}	Freisetzungs- versuche
Raps	Rapid Trait Development System (RTDS™), ODM	Pod Shatter Reduction (PSR)	Cibus Inc. (USA), Farmers Business Network (FBN) (CAN)	APHIS-Bescheid 2020 The U.S. Patent Office granted the company a patent for its pod shatter reduction (PSR) trait. <u>September 2024: Cibus “announced that it has completed initial field tests of its Pod Shatter Reduction (PSR) trait in the United Kingdom. The initial data from these trials support Cibus’ continuing commercial development of its PSR trait in winter oilseed rape. These trials represent an important progression in the Company’s commercial development with the application of Cibus’ spring oilseed rape (canola) PSR trait to winter oilseed rape.”⁴</u>	Ja <u>A second season of trials are now underway</u>
Raps	Rapid Trait Development System (RTDS™), ODM	Krankheitsresistenz gegen <i>Sclerotinia</i> , Weissstängeligkeit ⁵	Cibus Inc. (USA)	APHIS-Bescheid 2020 <u>November 2024: Cibus “announced that it has successfully completed edits in Canola for its 4th mode of action for its Sclerotinia resistance trait and expects greenhouse results in the first quarter of 2025.”⁶</u>	Ja

⁴ <https://investor.cibus.com/node/9806/pdf>

⁵ <https://www.cibus.com/pdfs/articles/Western-Producer-Cibus-Sclerotinia-20230706.pdf>

⁶ <https://investor.cibus.com/node/9931/pdf>

Kultur	Verfahren ^{a)}	Eigenschaften	Unternehmen ^{b)}	Entwicklungs-status ^{c)}	Freisetzungs-versuche
Raps	Rapid Trait Development System (RTDS™), ODM	Effiziente Stickstoff-Verwertung	Cibus Inc. (USA)	June 2024: Cibus “announced it has confirmed it has successfully made edits in Canola for its initial Nutrient Use Efficiency (NUE) trait. These newly edited plants will now be tested in controlled environments. If successful, Cibus expects this will mark a milestone of what is believed to be the first NUE gene edits in a major crop in North America.” ⁷	Nein
Soja NEU	CRISPR Qi Biodesign is engaged in genomic innovation with its proprietary SEEDIT research platform. The platform features advanced genome editing tools, including novel RNA-guided nucleases, base editors, plant prime editors and PrimeRoot editors for exact large DNA insertions & manipulations. ⁸	Increase in oleic acid and a decrease in linoleic acid	Suzhou Qihe Biotechnology Co., Ltd. (Qi Biodesign) (CHN)	The company received biosafety certificates for gene-edited plants (high oleic acid soybean) from the China Ministry of Agriculture and Rural Affairs. It also secured an exemption for a gene-edited product (high oleic acid soybean) from the U.S. Department of Agriculture (APHIS-Bescheid 2024). ⁹	Unklar

7 <https://investor.cibus.com/node/9721/pdf>

8 <https://www.mobihealthnews.com/news/qi-biodesign-secures-75m-genome-editing-technology>, https://cd-healthinv.com/en/news_id1398.html

Kultur	Verfahren ^{a)}	Eigenschaften	Unternehmen ^{b)}	Entwicklungs-status ^{c)}	Freisetzungs-versuche
Soja NEU	CRISPR	Mutated GmLn gene to improve soybean yield traits QH64112	Suzhou Qihe Biotechnology Co., Ltd. (Qi Biodesign) (CHN)	Biosafety Certificate Validity (CHN): Dec. 2024 – Dec. 2029 ¹⁰	Unklar
Soja NEU	CRISPR	Mutated GmE1 and GmE1Lb genes to improve soybeans physiological traits E001SYFT	China Seed Group Co., Ltd. (CHN)	Biosafety Certificate Validity (CHN): Dec. 2024 – Dec. 2029 ¹¹	Unklar
Soja	Rapid Trait Development System (RTDS™), ODM	Herbizidresistenz	Cibus Inc. (USA)	Our herbicide resistance trait for Soybean is the same herbicide resistance trait we are developing in Canola. We have initiated editing this herbicide resistance trait (HT2) in Canola with greenhouse trait confirmation ongoing. We expect to initiate editing for this HT trait in Soybean as soon as our Soybean platform is developed. ¹²	Nein

⁹ <https://www.aphis.usda.gov/biotech-regulatory-status/regulatory-status-review-table>

¹⁰ https://apps.fas.usda.gov/newgainapi/api/Report/DownloadReportByFileName?fileName=New%20and%20Renewed%20Biosafety%20Certificates%20Issued%20-%20December%202024_Beijing_China%20-%20People%27s%20Republic%20of_CH2024-0180.pdf

¹¹ https://apps.fas.usda.gov/newgainapi/api/Report/DownloadReportByFileName?fileName=New%20and%20Renewed%20Biosafety%20Certificates%20Issued%20-%20December%202024_Beijing_China%20-%20People%27s%20Republic%20of_CH2024-0180.pdf

¹² <https://www.cibus.com/productivity-traits.php>

Kultur	Verfahren ^{a)}	Eigenschaften	Unternehmen ^{b)}	Entwicklungs-status ^{c)}	Freisetzungs-versuche
Soja	Rapid Trait Development System (RTDS™), ODM	Krankheitsresistenz (<i>Sclerotinia</i> , Weissstängeligkeit)	Cibus Inc. (USA)	We are very encouraged by our initial field trials for our initial trait for <i>Sclerotinia</i> (white mold) resistance in Canola and winter Oilseed Rape. We expect to initiate editing our <i>Sclerotinia</i> trait in Soybean as soon as our Soybean platform is developed.	Nein
Soja	Rapid Trait Development System (RTDS™), ODM	Nematodenresistenz	Cibus Inc. (USA)	Soybean Cyst Nematode is an incredibly damaging pest of Soybean in most Soybean growing areas of the America's that is capable of reducing yields dramatically. It is a key target of our trait development plans.	Nein

Kultur	Verfahren ^{a)}	Eigenschaften	Unternehmen ^{b)}	Entwicklungs-status ^{c)}	Freisetzungs- versuche
Soja	CRISPR Argentine startup Bioheuris is focused on weed control. They developed a technological platform with CRISPR gene editing for the herbicide tolerance trait. ¹³	Herbizidresistenz, <u>Ertragssteigerung</u> (Verschiedene Traits)	Bioheuris (ARG, USA), Santa Rosa Semillas (ARG), Grupo Don Mario (ARG), ACA (ARG)	Kommerzialisierung geplant. Arbeit an 6 verschiedenen HR-Traits. Anfrage bei der APHIS 2021 (Secure). ¹⁴ Weitere Anfrage 2022 (ev. neuer Trait). ¹⁵ Nichtregulierungsbescheid erteilt. ¹⁶ <u>Zulassung Brasilien 2021¹⁷</u> Zwei weitere APHIS-Bescheide 2023 a) ¹⁸ , b) ¹⁹ (Anträge auf Überprüfung des Regulierungsstatus) <u>APHIS-Bescheid 2024 (für HR-Trait)²⁰</u>	Unklar

13 <https://allianceforscience.org/blog/2023/02/latin-america-a-biotech-laboratory-and-world-champion-in-gmos-and-gene-editing/>

14 https://www.aphis.usda.gov/biotechnology/downloads/confirmation-response/20-317-01cr_a2.pdf

15 <https://www.aphis.usda.gov/biotechnology/downloads/confirmation-response/22-269-01cr-request.pdf>

16 https://www.aphis.usda.gov/biotechnology/downloads/confirmation-response/20-317-01cr_response_signed.pdf

17 [https://one.oecd.org/document/ENV/CBC/MONO\(2024\)22/en/pdf](https://one.oecd.org/document/ENV/CBC/MONO(2024)22/en/pdf)

18 <https://www.aphis.usda.gov/brs/pdf/rsr/23-216-01rsr-submission.pdf>, <https://www.aphis.usda.gov/brs/pdf/rsr/23-216-01rsr-review-response.pdf>

19 <https://www.aphis.usda.gov/brs/pdf/rsr/23-219-01rsr.pdf>, <https://www.aphis.usda.gov/brs/pdf/rsr/23-219-01rsr-response.pdf>

20 <https://www.aphis.usda.gov/biotech-regulatory-status/regulatory-status-review-table>

Kultur	Verfahren ^{a)}	Eigenschaften	Unternehmen ^{b)}	Entwicklungs- status ^{c)}	Freisetzungs- versuche
Soja	CRISPR (SDN2)	Drought tolerance ²¹	Corteva (USA), Agricultural Research Corporation (EMBRAPA) (BRA) ²²	Three main research projects were initiated in 2019 and leverage CRISPR-Cas9 gene-editing technology for trait development: Drought-tolerant soybeans Water stress and nematode infestation have become severe in certain areas of Brazil. This project focuses on providing drought-tolerant soybeans to farmers while also supporting sustainable production. ²³	Nein

21 <https://research.ncsu.edu/ges/files/2021/12/Alexandre-Nepomecuno-NCSU-IDB-BID-Gene-Editing-02Dec21.pdf> (Folie 24)

22 <https://publications.iadb.org/publications/english/document/Genome-Editing-in-Latin-America-Regional-Regulatory-Overview.pdf>

23 <https://www.openinnovation.corteva.com/innovation-stories/Delivering-Powerful-Solutions-to-Brazilian-Farmers.html>

Kultur	Verfahren ^{a)}	Eigenschaften	Unternehmen ^{b)}	Entwicklungs- status ^{c)}	Freisetzungs- versuche
Soja	CRISPR	Root-knot nematode-resistant soybeans	Corteva (USA), Agricultural Research Corporation (EMBRAPA) (BRA) ²⁴	Three main research projects were initiated in 2019 and leverage CRISPR-Cas9 gene-editing technology for trait development: Root-knot nematode-resistant soybeans As a result of the collaboration with Embrapa, Corteva has developed a novel method for efficiently screening candidate root disease resistance genes. Together the organizations are helping to provide insights into future breeding and biotech solutions for nematode resistance.²⁵	Nein

²⁴ <https://publications.iadb.org/publications/english/document/Genome-Editing-in-Latin-America-Regional-Regulatory-Overview.pdf>

²⁵ <https://www.openinnovation.corteva.com/innovation-stories/Delivering-Powerful-Solutions-to-Brazilian-Farmers.html>

Kultur	Verfahren ^{a)}	Eigenschaften	Unternehmen ^{b)}	Entwicklungs-status ^{c)}	Freisetzungs- versuche
Soja	CRISPR	Control of undesirable post-harvest darkening of common bean seed coat	Corteva (USA), Agricultural Research Corporation (EMBRAPA) (BRA) ²⁶	Three main research projects were initiated in 2019 and leverage CRISPR-Cas9 gene-editing technology for trait development: Control of undesirable post-harvest darkening of common bean seed coat The common bean is a staple food in Brazil. Consumers are highly selective against an undesirable dark color which can occur during post-harvest storage. This collaborative work will support common-bean growers, who are usually smallholder farmers, eager to reduce this undesirable trait. ²⁷	Nein
Soja	CRISPR (SDN1)	Anti-nutritional Factors	Corteva (USA), Agricultural Research Corporation (EMBRAPA) (BRA)	The National Biosafety Technical Commission (CTNBio) considered, in an extraordinary meeting on September 1st, that the soy genome editing, conducted by Embrapa with the CRISPR technique, to deactivate some anti-nutritional factors, results in conventional soy, therefore, non-transgenic. ²⁸	Unklar

²⁶ <https://publications.iadb.org/publications/english/document/Genome-Editing-in-Latin-America-Regional-Regulatory-Overview.pdf>

²⁷ <https://www.openinnovation.corteva.com/innovation-stories/Delivering-Powerful-Solutions-to-Brazilian-Farmers.html>

²⁸ <https://news.agropages.com/News/NewsDetail---44098.htm>

Kultur	Verfahren ^{a)}	Eigenschaften	Unternehmen ^{b)}	Entwicklungs-status ^{c)}	Freisetzungs- versuche
Soja	CRISPR	Greater protein content, optimized amino acid profiles, and lower levels of anti-nutritional factors	Corteva (USA), Bunge (USA) The companies have a multi-year collaboration to develop and commercialize soybean varieties	The companies expect to commercialize these soybean varieties by late this decade. ²⁹	Ja
Soja	CRISPR	Erhöhter Proteingehalt, Soja soll u. a. in Aquakulturen als Fischfutter genutzt werden. “Amfora is developing soybean varieties that can be used in plant-based meat and other high-value applications without the need for a capital intensive and costly concentration process.”	Amfora (USA), Corteva (USA) Amfora arbeitet zusätzlich an High-Protein Erbsen als Fleischersatz.	Unklar, ob sich APHIS-Bescheid von 2020 auch auf diese Sojalinien bezieht. <u>Neuer APHIS-Bescheid 2024.</u> ³⁰ <u>Amfora Launches First Commercial Products: Company's soy flour contains more than 60 percent protein.</u> <u>Erste (konventionell gezüchtete) Sorten sind auf dem Markt. Amfora's continues to develop additional variations by leveraging both conventional breeding and Amfora's patented gene editing technology.</u> ³¹	Ja

29 <https://www.corteva.com/resources/media-center/corteva-and-bunge-announce-collaboration-to-develop-amino-acid-enhanced-soybeans.html>

30 <https://www.aphis.usda.gov/sites/default/files/23-116-01rsr.pdf>, <https://www.aphis.usda.gov/sites/default/files/23-116-01rsr-response.pdf>,
<https://www.isaaa.org/kc/cropbiotechupdate/article/default.asp?ID=20796>

31 <https://amforainc.com/amfora-launches-first-commercial-products/>

Kultur	Verfahren ^{a)}	Eigenschaften	Unternehmen ^{b)}	Entwicklungs-status ^{c)}	Freisetzungs-versuche
Soja	CRISPR	Erhöhter Protein- und Ölgehalt	Corteva (USA)	APHIS-Bescheid 2020 In einer Investorenpräsentation (2023) heisst es: "Finally, we are collaborating to bring gene-edited soybeans to Europe to expand their plant-based protein production." ³²	Ja
Soja	CRISPR	Verschiedene Traits: Resistenz gegen Südliche Stinkwanze (<i>Nezara viridula</i>), Herbizidtoleranz, Trockentoleranz	DonMario Semillas (ARG, BRA) ³³ , gehört zur GDM Group (ARG) (diese plant einen Ausbau der Geschäftstätigkeiten in China, USA, Europa) ³⁴	Kommerzialisierung geplant ab 2025	Unklar

32 <https://investors.corteva.com/static-files/c023a381-083e-4c92-8614-941419d4615a>

33 <https://publications.iadb.org/publications/english/document/Genome-Editing-in-Latin-America-Regional-Regulatory-Overview.pdf>

34 <https://www.gdmseeds.com/wp-content/uploads/2021/07/GDM-Special-EN.pdf>

Kultur	Verfahren ^{a)}	Eigenschaften	Unternehmen ^{b)}	Entwicklungs- status ^{c)}	Freisetzungs- versuche
Soja	CRISPR	Trockenheitstoleranz	Agricultural Research Corporation (EMBRAPA) (BRA)	Im Sojaanbau haben Forscher von Embrapa Soja-Gene verändert, um eine Soja mit Trockenheitstoleranz zu erhalten, die die CTNBio-Bewertung bestanden hat und als nicht gentechnisch verändert (nicht-transgen) gilt. Diese Soja kann nun auf dem Feld getestet werden, um die Wirksamkeit des eingeführten Merkmals zu beweisen. Dieselbe Strategie verfolgte das Unternehmen GDM, das ebenfalls eine Sojabohne entwickelte, die für dieses Merkmal editiert wurde. (DeepL-Übersetzung) ³⁵	Unklar

35 <https://seednews.com.br/artigos/4384-ferramentas-biotecnologicas-de-ultima-geracao-podem-contribuir-para-obtencao-de-plantas-mais-adaptadas-a-mudancas-climaticas-edicao-janeiro-2024>

Kultur	Verfahren ^{a)}	Eigenschaften	Unternehmen ^{b)}	Entwicklungs-status ^{c)}	Freisetzungs- versuche
Soja Im Anbau?	CRISPR	Stilllegung eines anti-nutritional factor	Agricultural Research Corporation (EMBRAPA) (BRA) EMBRAPA has a broad range of crops — such as soybean, corn, and wheat — that are being improved with CRISPR, highlighting the traits of elimination of anti-nutritional compounds, better oil quality, and drought tolerance.	2022: Zulassung als non-GMO gemäss CTNBio. Embrapa kann die genetische Eigenschaft in ihre anderen Sorten einführen, die an verschiedene Produktionsregionen angepasst sind. Die Veränderung der Soja-DNA wurde jedoch bereits an einer hochproduktiven Sorte vorgenommen. Die veränderte Sorte ist bereit für die Registrierung und Vermarktung. ³⁶	Ja
Soja NEU Im Anbau?	CRISPR	Low-lecitin	Agricultural Research Corporation (EMBRAPA) (BRA)	2022: Zulassung Brasilien ³⁷	Ja
Soja	CRISPR	Nematodenresistenz	TMG – Tropical Melhoramento & Genética (BRA) ³⁸	APHIS-Bescheid 2020	Geplant (Brasilien)

36 <https://www.embrapa.br/busca-de-noticias/-/noticia/73468020/ctnbio-aprova-soja-da-embrapa-com-genoma-editado-para-reduzir-fatores-antinutricionais>

37 <http://ctnbio.mctic.gov.br/tecnologias-inovadoras-de-melhoramento-genetico-rn16->

38 <https://publications.iadb.org/publications/english/document/Genome-Editing-in-Latin-America-Regional-Regulatory-Overview.pdf>

Kultur	Verfahren ^{a)}	Eigenschaften	Unternehmen ^{b)}	Entwicklungs-status ^{c)}	Freisetzungs-versuche
Soja	CRISPR	Veränderte Fettsäurezusammensetzung (<i>High-oleic</i>) ToolGen developed high oleic acid soybean, a new cultivar that edited the FAD2 gene to substantially reduce linoleic acid, the main factor of the unhealthy trans-fat formation while increasing the level of oleic acid to even over that of olive oil.	ToolGen Inc. (KOR)	APHIS-Bescheid 2020. Kommerzialisierung geplant. In Phase III (kurz vor Kommerzialisierung). <u>Keine Änderung 2024.</u>³⁹ “ToolGen is cultivating diverse sales channels and waging business activities, including producing high oleic soybean and trans-fat-free soybean oil.”⁴⁰	Ja
Soja	CRISPR	Herbizidresistenz	ToolGen Inc. (KOR)	Zwischen Phase I und II. <u>Keine Änderung 2024.</u> ⁴¹	Unklar

³⁹ <http://www.toolgen.com/eng/crops>

⁴⁰ http://www.toolgen.com/eng/business/business_04.jsp

⁴¹ <http://www.toolgen.com/eng/crops>

Kultur	Verfahren ^{a)}	Eigenschaften	Unternehmen ^{b)}	Entwicklungs-status ^{c)}	Freisetzungs-versuche
Soja NEU	CRISPR	Herbizidresistenz The developed technology will specifically confer tolerance to two different groups of herbicides. Combining tolerance to the two herbicide groups offers soybean growers greater flexibility and efficiency in managing resistant and hard-to-control weeds, contributing to sustainable and productive farming practices.	ToolGen Inc. (KOR), PlantArcBio (ISR)	The partnership will leverage ToolGen's advanced CRISPR-Cas9 technology (foundation IP) with top-level experience in generating the edited soybean, and alongside PlantArcBio's disruptive DIPPER™ platform, a proprietary system for discovering and optimizing genes to enhance native traits. ⁴² APHIS-Bescheid 2024 ⁴³	Nein
Soja	CRISPR	Essential amino acid enhanced soy <u>Increase in oleic acid and a decrease in linoleic acid</u>	ToolGen Inc. (KOR)	Zwischen Phase I und II. <u>Keine Änderung 2024.</u> ⁴⁴ <u>APHIS-Bescheid 2024</u> ⁴⁵	Unklar

42 https://www.seedquest.com/news.php?type=news&id_article=159946&id_region=&id_category=2450&id_crop

43 <https://www.aphis.usda.gov/biotech-regulatory-status/regulatory-status-review-table>

44 <http://www.toolgen.com/eng/crops>

45 <https://www.aphis.usda.gov/biotech-regulatory-status/regulatory-status-review-table>

Kultur	Verfahren ^{a)}	Eigenschaften	Unternehmen ^{b)}	Entwicklungs-status ^{c)}	Freisetzungs-versuche
Soja NEU	Vermutlich CRISPR ⁴⁶	Altered yield, altered seed quality, altered nodulation	Inari Agriculture Inc. (USA)	APHIS-Bescheid 2024 ⁴⁷	Unklar
Soja NEU	Vermutlich CRISPR ⁴⁸	Altered plant architecture, altered yield, altered seed quality, altered nodulation	Inari Agriculture Inc. (USA)	APHIS-Bescheid 2024 ⁴⁹	Unklar
Soja NEU	Vermutlich CRISPR ⁵⁰	Altered plant architecture, altered yield	Inari Agriculture Inc. (USA)	APHIS-Bescheid 2024 ⁵¹	Unklar

46 <https://inari.com/our-technology/>

47 <https://www.aphis.usda.gov/biotech-regulatory-status/regulatory-status-review-table>

48 <https://inari.com/our-technology/>

49 <https://www.aphis.usda.gov/biotech-regulatory-status/regulatory-status-review-table>

50 <https://inari.com/our-technology/>

51 <https://www.aphis.usda.gov/biotech-regulatory-status/regulatory-status-review-table>

Kultur	Verfahren ^{a)}	Eigenschaften	Unternehmen ^{b)}	Entwicklungs-status ^{c)}	Freisetzungs-versuche
Soja	Vermutlich CRISPR⁵² Inari kombiniert herkömmliche Gentechnik mit Genome Editing. Anfang 2023 Patenterteilung für Transgenic INHT31 soybean plants comprising an edited MON-89788 soybean trait, delivering a weed management solution.⁵³	Keine Angabe (<i>Confidential Business Information</i>) Inari is using predictive research and gene editing in an effort to reach some key benchmarks: Increase the yield in corn, soybeans and wheat by as much as 20%; decrease the water needed to grow corn 40%; and decrease the nitrogen needed for corn growth 40%.	Inari Agriculture Inc. (USA) 1st Choice Seeds ist eines der Testunternehmen.⁵⁴ Unique commercial relationships with Independent Seed Companies (ISCs) selling directly to farmers. Superior feedback loop between Inari and farmers via ISCs, informing future products. Strategic partnerships with leading seed and produce companies enabling market expansion in new crops and regions.⁵⁵	APHIS-Bescheid 2020. Kommerzialisierung geplant. “Inari, the SEEDesign™ company, announced a strategic collaboration with Mertec, LLC and M.S. Technologies, LLC that enables access to a genetic base from Stine’s industry-leading soybean breeding program to accelerate the development of unique and competitive products.” <u>Inari is readying itself for commercialization with this latest funding round. Initial markets include the US, Canada and Australia. For now, the company will stick to row crops: soybeans, corn and wheat, with soybeans first to market in the US.</u>⁵⁶	Ja

52 <https://inari.com/our-technology/>

53 https://www.seedquest.com/news.php?type=news&id_article=135300&id_region=&id_category=&id_crop

54 <https://www.ibj.com/articles/2023-innovation-issue-inari-aims-to-boost-crop-yields-through-unique-gene-editing-technology>

55 <https://inari.com/seeddesign>

56 <https://agfundernews.com/seed-gene-editing-startup-inari-valued-at-165m-following-103m-fundraise>

Kultur	Verfahren ^{a)}	Eigenschaften	Unternehmen ^{b)}	Entwicklungs- status ^{c)}	Freisetzungs- versuche
Soja	CRISPR	Multiple traits	Forage Genetics (USA), Yield10 Bioscience (USA)	Forage Genetics research license expired due to their discontinuation of R&D investment in forage sorghum. ⁵⁷	Unklar

⁵⁷ <https://ir.yield10bio.com/static-files/5e2cb123-1be6-40cf-9a56-1d90f2bfb52a>

Kultur	Verfahren ^{a)}	Eigenschaften	Unternehmen ^{b)}	Entwicklungs-status ^{c)}	Freisetzungs-versuche
Soja	Genome-Editing (Ohne weitere Spezifizierung)	Trockentoleranz	GDM (ARG)	In December 2022, GDM, an Argentinean company working on improving soybeans, announced that Brazil's National Technical Biosafety Commission (CNTBio) has approved its first gene-edited drought tolerant soybean. André Beló, manager of new technologies at GDM, said that the gene-edited soybean was approved by CNTBio in Brazil in May, and greenlighted by the Argentine government in November. The company plans to commercialize the variety in Brazil during the 2027/28 harvest. In January 2023, GDM announced the approval of their gene-edited soybeans in Colombia.⁵⁸ The drought-tolerant soy requires further testing and may be commercially launched in 2026/2027.⁵⁹ <u>APHIS-Bescheid 2024⁶⁰</u>	Ja

58 <https://www.isaaa.org/kc/cropbiotechupdate/ged/article/default.asp?ID=19979>

59 <https://www.reuters.com/article/idUSL1N33H0HB/>

60 <https://www.aphis.usda.gov/biotech-regulatory-status/regulatory-status-review-table>

Kultur	Verfahren ^{a)}	Eigenschaften	Unternehmen ^{b)}	Entwicklungs- status ^{c)}	Freisetzungs- versuche
Soja	Genome-Editing (Ohne weitere Spezifizierung)	Trocken- und Hitzetoleranz	GDM (ARG)	The company had the second edited soy classified by CTNBio (Comissão Técnica Nacional de Biossegurança - National Technical Commission on Biosafety), an entity linked to the Ministry of Science, Technology, Innovations, and Communication, responsible for implementing the new National Biosafety Policy regarding certain Genetically Modified Organisms (GMOs) as non-GMO in May of this year and on November 25 in Argentina. The variety was developed to be more drought and heat tolerant.⁶¹ <u>2024: Zulassung Brasilien</u>⁶²	Ja

61 <https://www.gdmseeds.com/wp-content/uploads/2022/12/03.Segunda-soja-DT-ING.pdf>

62 [https://one.oecd.org/document/ENV/CBC/MONO\(2024\)22/en/pdf](https://one.oecd.org/document/ENV/CBC/MONO(2024)22/en/pdf)

Kultur	Verfahren ^{a)}	Eigenschaften	Unternehmen ^{b)}	Entwicklungs- status ^{c)}	Freisetzungs- versuche
Soja Im Anbau?	Genome-Editing (Ohne weitere Spezifizierung)	Greater nutritional value because it has fewer raffinose and stachyose sugars, indigestible by monogastric animals, such as poultry, pigs, and humans	GDM (ARG)	The company continues to produce larger volumes of seeds of this variety for final validations before the commercial launch. Zulassung (als non-GMO): Brasilien, Argentinien, Kolumbien. The next step is to intensify contacts with local companies interested in using this soybean.⁶³ The low-sugar soy designed to help animal digestion could be launched in 2024/2025.⁶⁴	Ja

63 <https://www.gdmseeds.com/wp-content/uploads/2022/12/03.Segunda-soja-DT-ING.pdf>

64 <https://www.reuters.com/article/idUSL1N33H0HB/>

Kultur	Verfahren ^{a)}	Eigenschaften	Unternehmen ^{b)}	Entwicklungs-status ^{c)}	Freisetzungs-versuche
Soja Im Anbau?	CRISPR	High-Oleic	Shandong BellaGen Biotechnology Co. (CHN) <u>According to Li Guofu, deputy general manager of BellaGen, the company has cultivated over 20 new high-yield crop varieties, including high-yield rice and high-oleic soybeans, which have obtained the necessary certificates for industrial production.</u> ⁶⁵	In April 2023, China's Ministry of Agriculture and Rural Affairs (MOA) <u>issued its first safety certificate</u> for plant gene editing for a <u>high oleic acid soybean</u> by Shandong BellaGen Biotechnology Co. BellaGen is the first company in China to initiate industrial-scale plant gene editing. Approval is expected soon for the general development of gene-edited soybeans.⁶⁶	Ja
Soja	CRISPR	Altered Seed Morphology and Composition	Benson Hill (USA) <u>Benson Hill vermarktet inzwischen diverse (konventionell entwickelte) Sojasorten (Schwerpunkt für Tierfutter).</u> ⁶⁷	APHIS-Bescheid (Confirmation letter)⁶⁸ 2023: 12x Briefwechsel und APHIS-Bescheide (Confirmation letter), gleicher Trait, unterschiedliche Linien.⁶⁹ <u>Mehrere APHIS-Bescheide 2024</u>⁷⁰	Unklar

65 http://shandong.chinadaily.com.cn/2024-04/19/c_983400.htm

66 <https://crispr-gene-editing-regs-tracker.geneticliteracyproject.org/china-crops-food/>

67 <https://bensohill.com/products/seeds/>

68 <https://www.aphis.usda.gov/biotechnology/downloads/confirmation-response/22-207-01cr-request.pdf>,
<https://www.aphis.usda.gov/biotechnology/downloads/confirmation-response/22-207-02cr-request.pdf>,
<https://www.aphis.usda.gov/biotechnology/downloads/confirmation-response/22-207-03cr-request.pdf>

69 Beispiellinie: <https://www.aphis.usda.gov/biotechnology/downloads/confirmation-response/23-275-01cr-request.pdf>,
<https://www.aphis.usda.gov/biotechnology/downloads/confirmation-response/23-275-01cr-signed-response.pdf>. Weitere Dokumente hier:
<https://www.aphis.usda.gov/aphis/ourfocus/biotechnology/regulatory-processes/confirmations/responses/cr-table>

Kultur	Verfahren ^{a)}	Eigenschaften	Unternehmen ^{b)}	Entwicklungs-status ^{c)}	Freisetzungs- versuche
Soja	CRISPR	Verbesserter Geschmack, veränderter Ölgehalt	Benson Hill (USA) <u>Benson Hill vermarktet inzwischen diverse Sojasorten (Schwerpunkt für Tierfutter).</u> ⁷¹	APHIS-Bescheid (Confirmation letter) ⁷² 2023: 3x Briefwechsel und APHIS-Bescheide (Confirmation letter), gleicher Trait, unterschiedliche Linien ⁷³ <u>Mehrere APHIS-Bescheide 2024</u> ⁷⁴	Ja
Soja	CRISPR	Herbizidresistenz	Bioheuris (ARG, USA), Santa Rosa Semillas (ARG), Grupo Don Mario (ARG), ACA (ARG) <u>In partnerships with Santa Rosa Semillas, Grupo Don Mario and ACA, we started collaboration agreements to develop management systems for high-yield soybean varieties.</u> ⁷⁵	2023: APHIS-Bescheid (Confirmation letter) ⁷⁶ <u>APHIS-Bescheid 2024</u> ⁷⁷	Unklar

70 <https://www.aphis.usda.gov/sites/default/files/24-060-01cr-request.pdf>, <https://www.aphis.usda.gov/sites/default/files/24-060-02cr-response.pdf>

71 <https://bensohill.com/products/seeds/>

72 <https://www.aphis.usda.gov/biotechnology/downloads/confirmation-response/22-207-04cr-request.pdf>

73 Beispiellinie: <https://www.aphis.usda.gov/biotechnology/downloads/confirmation-response/23-268-03cr-request.pdf>, <https://www.aphis.usda.gov/biotechnology/downloads/confirmation-response/23-268-03cr-signed-response.pdf>. Weitere Dokumente hier: <https://www.aphis.usda.gov/aphis/ourfocus/biotechnology/regulatory-processes/confirmations/responses/cr-table>

74 <https://www.aphis.usda.gov/sites/default/files/24-060-01cr-request.pdf>, <https://www.aphis.usda.gov/sites/default/files/24-060-02cr-response.pdf>

75 <https://www.bioheuris.com/en/what-we-do/>

Kultur	Verfahren ^{a)}	Eigenschaften	Unternehmen ^{b)}	Entwicklungs-status ^{c)}	Freisetzungs-versuche
Baumwolle	CRISPR	Herbizidresistenz	Bioheuris (ARG, USA), Gensus (ARG) <u>With Gensus, the Argentine cotton seed company, we are developing herbicides resistant varieties to combat weeds, which, in addition to reducing yield, contaminate cotton lint, reducing its quality.</u>	APHIS-Bescheid ⁷⁸ (Antrag auf Überprüfung des Regulierungsstatus) 2022 bereits APHIS-Bescheid (Confirmation letter), gleicher Trait ⁷⁹ <u>APHIS-Bescheid 2024⁸⁰</u>	Nein
Mais NEU	CRISPR	Insektenresistenz	KWS Saat AG (DEU)	2023: Zulassung in Brasilien ⁸¹	Unklar

76 <https://www.aphis.usda.gov/biotechnology/downloads/confirmation-response/22-269-01cr-request.pdf>,
<https://www.aphis.usda.gov/biotechnology/downloads/confirmation-response/22-269-01cr-response-signed.pdf>

77 <https://www.aphis.usda.gov/biotech-regulatory-status/regulatory-status-review-table>

78 <https://www.aphis.usda.gov/brs/pdf/rsr/23-216-02rsr.pdf>, <https://www.aphis.usda.gov/brs/pdf/rsr/23-216-02rsr-response.pdf>

79 <https://www.aphis.usda.gov/biotechnology/downloads/confirmation-response/22-269-02cr-request.pdf>,
<https://www.aphis.usda.gov/biotechnology/downloads/confirmation-response/22-269-02cr-response-signed.pdf>

80 <https://www.aphis.usda.gov/biotech-regulatory-status/regulatory-status-review-table>

81 [https://one.oecd.org/document/ENV/CBC/MONO\(2024\)22/en/pdf](https://one.oecd.org/document/ENV/CBC/MONO(2024)22/en/pdf)

Kultur	Verfahren ^{a)}	Eigenschaften	Unternehmen ^{b)}	Entwicklungs-status ^{c)}	Freisetzungs-versuche
Mais NEU	CRISPR Origin Agritech's breakthrough gene editing technology, including the world's first efficient genetic transformation system for maize induction line Hi3, is central to the consortium's mission. This gene editing system rapidly improves key traits such as drought resistance, plant architecture, and disease resilience in maize, reducing the traditional breeding timeline from 3-4 years to just one. ⁸²	Erhöhter Ertrag The new gene-edited corn inbred line demonstrated a yield increase of over 50% compared to the original line ⁸³	Origin Agritech Ltd. (CHN)	The Company plans to fully integrate this trait into its elite commercial corn line by the end of 2024. This integration is expected to greatly enhance seed yield and significantly reduce the cost of hybrid seed production. In addition, Origin will conduct field demonstrations and seed production trials in the summer of 2024. Publikation in Nature. ⁸⁴	Ja, 2 Jahre

82 <https://originagritech.com/origin-agritech-establishes-biotechnology-service-consortium-to-accelerate-licensing-and-commercialization-of-gmo-and-gene-editing-technologies/>

83 https://www.seedquest.com/news.php?type=news&id_article=153278&id_region=&id_category=2450&id_crop, <https://originagritech.com/>

84 <https://originagritech.com/origin-agritech-provides-first-half-revenue-forecast-and-updates-advancements-in-hybrids-and-gmo-development-2-2-2/>, <https://www.nature.com/articles/s41586-024-07669-6>

Kultur	Verfahren ^{a)}	Eigenschaften	Unternehmen ^{b)}	Entwicklungs-status ^{c)}	Freisetzungs- versuche
Mais NEU	CRISPR	Mutated ZmNL4 gene to improve corn yield traits KN-NL4-2	Weimi Biotechnology (Hainan) Co., Ltd. (CHN), Huazhong Agricultural University (CHN)	Biosafety Certificate Validity (CHN): Dec. 2024 – Dec. 2029 ⁸⁵	Unklar
Mais Im Anbau?	CRISPR	Resistenz gegen <i>Maize Lethal Necrosis Disease</i>	Corteva (USA), CIMMYT (MEX) ⁸⁶	Maissorten sollen für afrikanische Kleinbauern entwickelt werden: “By 2025, subject to compliance with regulatory procedures, commercial seeds of the gene-edited MLN-resistant elite maize hybrids will be available to up to 20,000 smallholder farmers for approximately 40,000 hectares of planting.”⁸⁷ Investorenpräsentation, Folie 29:⁸⁸ “In most of these examples, Corteva is doing the gene editing technical work and collaborated on field testing and evaluations. In the disease resistance space, we have enhanced local germplasm in Africa to be resistant to maize leaf necrosis, which is a virus that can wipe out maize production.”	Ja Gemäss Zeitplan sollte das erste Maissaatgut bereits Mitte 2023 erhältlich sein.⁸⁹

⁸⁵ https://apps.fas.usda.gov/newgainapi/api/Report/DownloadReportByFileName?fileName=New%20and%20Renewed%20Biosafety%20Certificates%20Issued%20-%20December%202024_Beijing_China%20-%20People%27s%20Republic%20of_CH2024-0180.pdf

⁸⁶ <https://publications.jrc.ec.europa.eu/repository/handle/JRC123830>, S. 21

⁸⁷ <https://www.cimmyt.org/projects/mln-gene-editing-project/>

⁸⁸ <https://investors.corteva.com/static-files/2986689f-fbf9-4c02-a7eb-a97995ad5fc0>

Kultur	Verfahren ^{a)}	Eigenschaften	Unternehmen ^{b)}	Entwicklungs-status ^{c)}	Freisetzungs- versuche
Mais Mais DP915635 Im Anbau	CRISPR Transgenese	Tolerance to glufosinate herbicide and resistance to corn rootworm pests	Corteva (USA)	2020 Antrag auf Importzulassung (food & feed) bei EFSA ⁹⁰ November 2023: Positive scientific opinion (EFSA) veröffentlicht. Juli 2024: Importzulassung in EU. ⁹¹	Ja (USA, Kanada)
Mais Mais DP910521 Im Anbau	CRISPR Transgenese	Resistenz gegen das Herbizid Glufosinat auf und produziert ein neuartiges Insektengift (Cry1B.34)	Corteva (USA)	Antrag auf Importzulassung (food & feed) bei EFSA August 2024: Positive scientific opinion (EFSA) veröffentlicht. ⁹²	Ja (USA, Kanada)
Mais NEU	CRISPR	Fungal Resistance	Corteva Agriscience do Brasil Ltda. (USA, BRA)	2023: Zulassung Brasilien ⁹³	Unklar

89 <https://repository.cimmyt.org/bitstream/handle/10883/21893/64898.pdf?sequence=1&isAllowed=y>

90 https://www.testbiotech.org/sites/default/files/EFSA-Q-2020-00834-EFSA-GMO-NL-2020-172_%20Summary.pdf,
<https://www.testbiotech.org/pressemitteilung/erster-zulassungsantrag-fuer-crispr-pflanzen-in-eu>

91 <https://webgate.ec.europa.eu/dyna2/gm-register/details/236>

92 <https://www.efsa.europa.eu/en/efsajournal/pub/8887>

93 [https://one.oecd.org/document/ENV/CBC/MONO\(2024\)22/en/pdf](https://one.oecd.org/document/ENV/CBC/MONO(2024)22/en/pdf)

Kultur	Verfahren ^{a)}	Eigenschaften	Unternehmen ^{b)}	Entwicklungs-status ^{c)}	Freisetzungs-versuche
Mais	CRISPR (Cas-Enzym undeclariert, patentiert von Inari) SEEDesign™ a) Predictive Design: creating an editing blueprint through deep learning and machine learning b) Multiplex editing toolkit: facilitating multiple edits across multiple genes⁹⁴	Keine Angabe (<i>Confidential Business Information</i>) Efficiency improvements: product pipeline includes fertilizer and water use Yield increase: projecting +20% in Inari's current crops vs. historical increases of ~1% per year	Inari Agriculture Inc. (USA) <u>Inari is readying itself for commercialization with this latest funding round. Initial markets include the US, Canada and Australia. For now, the company will stick to row crops: soybeans, corn and, wheat, with soybeans first to market in the US.</u>⁹⁵	APHIS-Bescheid 2020. Kommerzialisierung geplant. “The combination of Inari’s novel predictive design and advanced multiplex gene editing technology with Beck’s established corn research and breeding program will increase product testing capabilities and expand both companies’ capacity for innovation.”⁹⁶ Inari kombiniert herkömmliche Gentechnik mit Genome Editing. Anfang 2023 Patenterteilung für <u>Transgenic INIR6 corn plants</u> comprising an edited DP-4114 corn trait, delivering insect protection.⁹⁷	Unklar

94 <https://inari.com/seeddesign>

95 <https://agfundernews.com/seed-gene-editing-startup-inari-valued-at-165m-following-103m-fundraise>

96 <https://inari.com/news/inari-and-becks-announce-strategic-collaboration-to-accelerate-farmer-access-to-gene-editing-innovation>

97 https://www.seedquest.com/news.php?type=news&id_article=135300&id_region=&id_category=&id_crop

Kultur	Verfahren ^{a)}	Eigenschaften	Unternehmen ^{b)}	Entwicklungs-status ^{c)}	Freisetzungs- versuche
Mais	CRISPR (Cas-Enzym undeclariert, patentiert von Inari)	Verkürzte Stängellänge	Inari Agriculture Inc. (USA) <u>Inari is readying itself for commercialization with this latest funding round. Initial markets include the US, Canada and Australia. For now, the company will stick to row crops: soybeans, corn and, wheat, with soybeans first to market in the US.</u> ⁹⁸	APHIS-Bescheid 2023 ⁹⁹ (Antrag auf Überprüfung des Regulierungsstatus) Freisetzungsversuch in Belgien läuft unter dem Titel «R&D Field trial to evaluate the phenotype and yield of maize lines gene edited for reduced height»	Ja, Belgien 15/04/2023 to 30/11/2023 ¹⁰⁰ & neuer Antrag für 2024 ¹⁰¹
Mais NEU	Vermutlich CRISPR ¹⁰²	Altered seed yield	Inari Agriculture Inc. (USA)	APHIS-Bescheid 2024 ¹⁰³	Unklar

98 <https://agfundernews.com/seed-gene-editing-startup-inari-valued-at-165m-following-103m-fundraise>

99 <https://www.aphis.usda.gov/brs/pdf/rsr/23-101-01rsr-submission.pdf>, <https://www.aphis.usda.gov/brs/pdf/rsr/23-101-01rsr-review-response.pdf>

100 <https://ec.europa.eu/food/food-feed-portal/screen/gmob/search/details/POL-GMOB-IMPORT-10016>

101 <https://ec.europa.eu/food/food-feed-portal/screen/gmob/search/details/POL-GMOB-IMPORT-10020>

102 <https://inari.com/our-technology/>

103 <https://www.aphis.usda.gov/biotech-regulatory-status/regulatory-status-review-table>

Kultur	Verfahren ^{a)}	Eigenschaften	Unternehmen ^{b)}	Entwicklungs-status ^{c)}	Freisetzungs- versuche
Mais NEU	CRISPR	Improved resistance to four fungal diseases: northern corn leaf blight, gray leaf spot, anthracnose stalk rot, and southern corn rust	Corteva (Pioneer) (USA)	Targeted incorporation of native maize genes (cisgenes) that confer resistance to fungal diseases Markteinführung ab 2028 ¹⁰⁴ Aufgeführt auf der Kanadischen List of non-novel products of plant breeding for food use ¹⁰⁵ APHIS-Bescheid 2024 ¹⁰⁶	Unklar
Mais Im Anbau	CRISPR	Veränderte Stärkezusammensetzung (waxy corn)	Corteva (USA)	APHIS-Bescheid 2016 Anbauzulassung in den USA, Kanada, Brasilien, Argentinien, Chile ¹⁰⁷ und Japan. ¹⁰⁸	Ja
Mais	CRISPR	Trockenheitstoleranz und Ertragsstabilität	Corteva (USA)	APHIS-Bescheid 2020.	USA, ab 2016
Mais	CRISPR	Höheres Ertragspotential (<i>enhanced yield potential</i>)	Corteva (USA)	APHIS-Bescheid 2020	Unklar

104 <https://investors.corteva.com/static-files/5b4c2e4c-8973-48b9-a0cf-c1b9b20a0d0d>

105 <https://www.canada.ca/en/health-canada/services/food-nutrition/genetically-modified-foods-other-novel-foods/transparency-initiative/list-non-novel-products-plant-breeding-food-use.html>

106 <https://www.aphis.usda.gov/biotech-regulatory-status/regulatory-status-review-table>

107 <https://www.ohnegentechnik.org/artikel/nicht-zugelassene-gentechnik-staerke-koennte-unerkannt-nach-europa-gelangen>

108 <https://www.isaaa.org/kc/cropbiotechupdate/article/default.asp?ID=20131>

Kultur	Verfahren ^{a)}	Eigenschaften	Unternehmen ^{b)}	Entwicklungs-status ^{c)}	Freisetzungs-versuche
Mais	CRISPR	Höherer Kornertrag (<i>increased grain yield</i>)	Corteva (USA)	APHIS-Bescheid 2020	Unklar
Mais	CRISPR	Pilzresistenz	Evogene (ISR),¹⁰⁹ Bayer Crop Science (DEU) Wenn, dann wird Bayer den Mais vermarkten. Evogene arbeitet über die Tochtergesellschaft Castera Ag, Ltd. nur noch an Rhizinus. ¹¹⁰	Forschung & Entwicklung “Evogene Ltd., a leading computational biology company targeting to revolutionize life-science product discovery and development across multiple market segments, announced today that Bayer will pay Evogene an amount of \$3.5 million under their joint seed traits collaboration agreement. Under the collaboration agreement, Evogene provided Bayer with a license to genes discovered to address specific seed traits, for use in corn, soy, cotton, and canola. The payment is part of a restructuring of the patent filing, prosecution, and maintenance obligations under the collaboration.” ¹¹¹	Geplant

¹⁰⁹ <https://www.prnewswire.com/news-releases/evogene-amends-its-collaboration-agreement-with-bayer-to-include-genome-editing-targets-300885511.html>

¹¹⁰ https://evogene.com/wp-content/uploads/2023/05/Castera_company_presentation_May_2023_FINAL.pdf

¹¹¹ <https://www.en.krishakjagat.org/investment-startups/evogene-to-receive-3-5-million-payment-related-to-patent-portfolio-under-its-existing-seed-traits-collaboration-with-bayer/>

Kultur	Verfahren ^{a)}	Eigenschaften	Unternehmen ^{b)}	Entwicklungs-status ^{c)}	Freisetzungs-versuche
Mais	CRISPR	Herbizidresistenz	ToolGen Inc. (KOR)	Zwischen Phase I und II. <u>Keine Änderung 2024.</u> ¹¹²	Unklar
Mais	Genome-Editing (nicht weiter spezifiziert)	Production of Anthocyanin in response to pathogen infection Corn will be modified to produce anthocyanin in response to pathogen infection via placement of a gene responsible for activating anthocyanin biosynthesis downstream of a pathogen-responsive promoter.	INSIGNIUM AgTech (USA), Beck`s (USA) <u>Insignum AgTech® and Beck's have signed an agreement to test Insignum's innovative corn traits in Beck's elite varieties. The companies will collaborate to cross the trait into proprietary Beck's genetics for field-testing in 2023 to evaluate commercial viability of the traits.</u>¹¹³	APHIS-Bescheid 2023.¹¹⁴ (Antrag auf Überprüfung des Regulierungsstatus) Patentantrag läuft. <u>APHIS-Bescheid 2024. A ruling by the U.S. Department of Agriculture's Animal and Plant Health Inspection Service allows farmers and growers to run trials on corn plants developed by Insignum AgTech.</u>¹¹⁵	Ja Our plants have been field tested for two years¹¹⁶

112 <http://www.toolgen.com/eng/crops>

113 <https://www.purdue.edu/newsroom/2023/Q2/insignum-agtech-and-becks-collaborate-to-help-corn-talk/>

114 <https://www.aphis.usda.gov/brs/pdf/rsr/23-087-01rsr-submission.pdf>, <https://www.aphis.usda.gov/brs/pdf/rsr/23-087-01rsr-review-response.pdf>

115 https://www.seedquest.com/news.php?type=news&id_article=151177&id_region=&id_category=2450&id_crop

116 <https://www.insignumagtech.com/>

Kultur	Verfahren ^{a)}	Eigenschaften	Unternehmen ^{b)}	Entwicklungs-status ^{c)}	Freisetzungs-versuche
Mais	CRISPR	Altered yield characteristics	Inari Agriculture Inc. (USA) <u>Inari is readying itself for commercialization with this latest funding round. Initial markets include the US, Canada and Australia. For now, the company will stick to row crops: soybeans, corn and, wheat, with soybeans first to market in the US.</u>¹¹⁷	2023: APHIS-Bescheid (Confirmation letter) ¹¹⁸	Unklar

¹¹⁷ <https://agfundernews.com/seed-gene-editing-startup-inari-valued-at-165m-following-103m-fundraise>

¹¹⁸ <https://www.aphis.usda.gov/biotechnology/downloads/confirmation-response/23-209-02cr-request.pdf>,
<https://www.aphis.usda.gov/biotechnology/downloads/confirmation-response/23-209-02cr-signed-response.pdf>

Kultur	Verfahren ^{a)}	Eigenschaften	Unternehmen ^{b)}	Entwicklungs- status ^{c)}	Freisetzungs- versuche
Mais	CRISPR <u>Syngenta will provide rights to selected genome-editing and breeding technologies for academic research globally, as part of its commitment to foster innovation and drive sustainability in agriculture. These rights are accessible through its innovation collaboration platform Shoots by Syngenta.</u> ¹¹⁹	Maize haploid inducer line	Syngenta Seeds LLC (CHN, CH)	APHIS-Bescheid (Confirmation letter) ¹²⁰	Unklar

119 <https://shootsbysyngenta.com/outlicensing>

120 <https://www.aphis.usda.gov/biotechnology/downloads/confirmation-response/23-062-01cr-request.pdf>,
<https://www.aphis.usda.gov/biotechnology/downloads/confirmation-response/23-062-01cr-response-signed.pdf>

Kultur	Verfahren ^{a)}	Eigenschaften	Unternehmen ^{b)}	Entwicklungs-status ^{c)}	Freisetzungs- versuche
Mais	CRISPR To speed up the process, Bayer and other companies [incl. Corteva] are working on short corn made with gene editing, an approach that can alter gibberellin without adding genes from other species. Corn varieties created this way will face fewer regulatory hurdles in the U.S. and some other countries, but they're still years away.¹²¹	Verkürzte Stängellänge Bayers Preceon™ Smart Corn System Am gleichen Trait arbeiten auch Corteva, Stine Seeds und Inari.¹²²	Bayer CropScience (GER), Pairwise (USA)¹²³ Furthermore, the company is working on a gene-edited version of Preceon in partnership with Pairwise to appeal to various global markets¹²⁴	Bayer has used conventional breeding to create three short hybrid varieties that were tested for the U.S. market this summer (2023) and are now being harvested by about 300 farmers. Bayer arbeitet darüber hinaus an transgenen Maissorten.¹²⁵ <u>The PRECEON biotech approach in partnership with BASF has advanced to Phase 4 this year and is scheduled to launch in the US in 2027 with Canada expected to follow in 2029.</u>¹²⁶	Nein

121 <https://www.science.org/content/article/shrinking-corn-help-farmers-environment>

122 <https://americanfarmpublications.com/buzz-over-short-stature-corn-has-industry-talking/>

123 <https://www.pairwise.com/news/gene-editing-pairwise-and-bayer-start-new-five-year-multi-million-dollar-collaboration-to-further-advance-short-stature-corn>

124 <https://www.bayer.com/en/us/news-stories/2024-ag-innovation-update>

125 <https://www.isaaa.org/kc/cropbiotechupdate/article/default.asp?ID=20286>

126 <https://www.bayer.com/en/agriculture/preceon-smart-corn-system>

Kultur	Verfahren ^{a)}	Eigenschaften	Unternehmen ^{b)}	Entwicklungs-status ^{c)}	Freisetzungs-versuche
Reis NEU	CRISPR	Altered nutritional profile, Increased protein in leaves and seeds	Amfora Inc. (USA), Mississippi State University (USA)	APHIS-Bescheid 2024 ¹²⁷	Unklar
Reis NEU	SWAP™ tissue culture protocols and state-of-the-art gene editing techniques HEURIK™ high-throughput platform	Herbizidresistenz	Bioheuris (ARG, USA), Itá Caabó (ARG)	We recently started a development program with Itá Caabó from Adecoagro group, one of the main food and renewable energy companies in South America and the largest rice breeder and producer in Argentina, to optimize integrated management of rice through gene editing of elite varieties and hybrids.	Unklar

127 <https://www.aphis.usda.gov/biotech-regulatory-status/regulatory-status-review-table>

Kultur	Verfahren ^{a)}	Eigenschaften	Unternehmen ^{b)}	Entwicklungs-status ^{c)}	Freisetzungs-versuche
Reis	CRISPR	Resistant to bacterial blight disease ¹²⁸	International Rice Research Institute (IRRI), International Center of Tropical Agriculture (CIAT) ¹²⁹	Zulassung in den USA und Kolumbien. ¹³⁰ Anbau unklar. Wissenschaftliche Publikation erschienen. ¹³¹ “Kenya evaluates applications for the import of transgene-free lines on a case-by-case basis, thus it will be necessary to prepare suitable documentation for import. In parallel, it is planned to use the hybrid Cas9/Cpf1 strategy to expand the resistant germplasm to other rice varieties grown in African countries to be able to meet consumer-farmer preferences. This project aims to ultimately provide the material to small-scale producers. It will also be necessary to continue monitoring disease and Xoo populations.”	Unklar

128 <http://www.knowledgebank.irri.org/decision-tools/rice-doctor/rice-doctor-fact-sheets/item/bacterial-blight>

129 <https://www.nature.com/articles/s41587-019-0267-z>, <https://publications.jrc.ec.europa.eu/repository/handle/JRC123830>, S. 21

130 <https://geneticliteracyproject.org/2021/08/02/gene-edited-crops-made-in-latin-america-for-latin-american-needs/>

131 <https://pubmed.ncbi.nlm.nih.gov/37337668/>

Kultur	Verfahren ^{a)}	Eigenschaften	Unternehmen ^{b)}	Entwicklungs- status ^{c)}	Freisetzungs- versuche
Reis	Rapid Trait Development System (RTDS™), ODM	Herbizidresistenz (HT 1)	Cibus Inc. (USA), Loveland Products (USA) Under the terms of the <u>agreement Loveland and Cibus will work toward commercializing herbicide tolerance in rice with a focus on the southern US market, where demand for novel approaches in weed control is most prevalent.</u> ¹³² <u>Collaboration Agreement with Interoc (Latin America). Cibus has agreed to partner with Interoc to provide traits for Interoc's elite rice seed genetics.</u> ¹³³	APHIS-Bescheid 2020 In April 2023, we transferred our two herbicide traits in Rice to a customer in their elite germplasm for commercial development. We expect initial launch of at least one of these traits in the next 2-3 years. ¹³⁴ <u>Cibus announced that it has positive initial field trial results of a novel weed management solution for rice farmers. Initial results have shown that using two herbicides provided an excellent weed management system in rice.</u> ¹³⁵	Ja <u>Cibus expects to have field scale demonstrations of the HT rice traits in the US Mid-South in 2024 and expand to other geographies in 2025.</u> ¹³⁶

132 <https://investor.cibus.com/node/9456/pdf>

133 <https://investor.cibus.com/node/9421/pdf>

134 <https://www.cibus.com/productivity-traits.php>

135 <https://investor.cibus.com/node/9761/pdf>

136 <https://investor.cibus.com/node/9436/pdf>

Kultur	Verfahren ^{a)}	Eigenschaften	Unternehmen ^{b)}	Entwicklungs- status ^{c)}	Freisetzungs- versuche
Reis	Rapid Trait Development System (RTDS™), ODM	Herbizidresistenz (HT 3)	Cibus Inc. (USA), Albaugh LLC (USA), RTDC Corporation Limited (USA), Loveland Products (USA) <u>Under the terms of the agreement Loveland and Cibus will work toward commercializing herbicide tolerance in rice with a focus on the southern US market, where demand for novel approaches in weed control is most prevalent.</u> ¹³⁷ <u>Collaboration Agreement with Interoc (Latin America). Cibus has agreed to partner with Interoc to provide traits for Interoc's elite rice seed genetics.</u> ¹³⁸	APHIS-Bescheid 2020 <u>Cibus announced an agreement affirming its collaboration with RTDC Corporation Limited and Albaugh LLC to provide Clethodim as part of Cibus' weed management solution for U.S. rice farmers using Cibus' HT-3 trait.</u> ¹³⁹	Ja <u>Cibus expects to have field scale demonstrations of the HT rice traits in the US Mid-South in 2024 and expand to other geographies in 2025.</u> ¹⁴⁰

137 <https://investor.cibus.com/node/9456/pdf>

138 <https://investor.cibus.com/node/9421/pdf>

139 https://www.seedquest.com/news.php?type=news&id_article=159701&id_region=&id_category=2450&id_crop

140 <https://investor.cibus.com/node/9436/pdf>

Kultur	Verfahren ^{a)}	Eigenschaften	Unternehmen ^{b)}	Entwicklungs-status ^{c)}	Freisetzungs-versuche
Reis	Rapid Trait Development System (RTDS™), ODM	Krankheitsresistenz	Cibus Inc. (USA)	Disease resistance is an incredibly important need for Rice farmers that may avoid multiple fungicide applications per year. It is a key target of our trait development plans. ¹⁴¹	Nein
Reis	Rapid Trait Development System (RTDS™), ODM	Effiziente Stickstoff-Verwertung	Cibus Inc. (USA)	We have initiated the editing process for our initial mode of action. We expect Nutrient Use Efficiency to comprise multiple modes of action. We will update as we progress on this important target.	Nein
Reis NEU	CRISPR	Mutated Wx gene to improved rice quality traits 118-9-15	Suzhou Qi-Biodesign Biotechnology Company Limited (CHN), Jiangsu Academy of Agricultural Sciences (CHN), Beijing Qi-Biodesign Biotechnology Company Limited (CHN)	Biosafety Certificate Validity (CHN): Dec. 2024 – Dec. 2029 ¹⁴²	Unklar

¹⁴¹ <https://www.cibus.com/productivity-traits.php>

¹⁴² <https://apps.fas.usda.gov/newgainapi/api/Report/DownloadReportByFileName?fileName=New%20and%20Renewed%20Biosafety%20Certificates%20Issued%20-%20December%202024%20Beijing%20China%20-%20People%27s%20Republic%20of%20CH2024-0180.pdf>

Kultur	Verfahren ^{a)}	Eigenschaften	Unternehmen ^{b)}	Entwicklungs-status ^{c)}	Freisetzungs-versuche
Reis	CRISPR	Herbizidresistenz We recently started a development program with Itá Caabó from Adecoagro group, one of the main food and renewable energy companies in South America and the largest rice breeder and producer in Argentina, to optimize integrated management of rice through gene editing of elite varieties and hybrids.	Bioheuris (ARG, USA), Itá Caabo (Group Adecoagro)	2022: APHIS-Bescheid (Confirmation letter) ¹⁴³ 2023: 3x APHIS-Bescheid (Confirmation letter) ¹⁴⁴ <u>2023: Zulassung Brasilien</u> ¹⁴⁵	Unklar
Kartoffel JA36 NEU	CRISPR	Higher tuber set Deletions in a gene that results in higher tuber set	Simplot Plant Sciences (USA)	Markteinführung: 2024 Aufgeführt auf der Kanadischen List of non-novel products of plant breeding for food use ¹⁴⁶	Ja

143 <https://www.aphis.usda.gov/biotechnology/downloads/confirmation-response/22-276-01cr-request.pdf>

144 <https://www.aphis.usda.gov/biotechnology/downloads/confirmation-response/23-033-02cr-request.pdf>,
<https://www.aphis.usda.gov/biotechnology/downloads/confirmation-response/23-033-02cr-response-signed.pdf>

145 [https://one.oecd.org/document/ENV/CBC/MONO\(2024\)22/en/pdf](https://one.oecd.org/document/ENV/CBC/MONO(2024)22/en/pdf)

146 <https://www.canada.ca/en/health-canada/services/food-nutrition/genetically-modified-foods-other-novel-foods/transparency-initiative/list-non-novel-products-plant-breeding-food-use.html>

Kultur	Verfahren ^{a)}	Eigenschaften	Unternehmen ^{b)}	Entwicklungs- status ^{c)}	Freisetzungs- versuche
Kartoffel	CRISPR	Resistenz gegen Schwarzfleckigkeit („non-browning“)	Simplot Plant Sciences (USA)	APHIS-Bescheid 2020.¹⁴⁷ Kommerzialisierung geplant. <u>Vermutlich werden auch diese Kartoffeln unter der Marke „Innate“ vertrieben.</u>¹⁴⁸ Simplot has executed a joint intellectual property licensing agreement with Corteva Agriscience, Agriculture Division of DowDuPont, and the Broad Institute of MIT and Harvard for foundational CRISPR-Cas9 and related gene editing tools. The technology provides Simplot with another avenue to bring desirable traits forward in potatoes.¹⁴⁹	Geplant

147 https://www.aphis.usda.gov/biotechnology/downloads/reg_loi/20-168-01_air_inquiry_cbidcl.pdf,
https://www.aphis.usda.gov/biotechnology/downloads/reg_loi/20-168-01_air_response_signed.pdf

148 <https://www.potatopro.com/brands/innate-potatoes>

149 <https://www.innatepotatoes.com/technology>

Kultur	Verfahren ^{a)}	Eigenschaften	Unternehmen ^{b)}	Entwicklungs-status ^{c)}	Freisetzungs- versuche
Kartoffel AP695	CRISPR	Reduzierter Gehalt an Glykoalkaloiden (u. a. Solanin) und Resistenz gegen Schwarzfleckigkeit („non-browning“)	Simplot Plant Sciences (USA)	APHIS-Bescheid 2020. ¹⁵⁰ Kommerzialisierung geplant <u>Vermutlich werden auch diese Kartoffeln unter der Marke „Innate“ vertrieben.</u> ¹⁵¹ <u>Markteinführung: 2025</u> <u>Aufgeführt auf der Kanadischen List of non-novel products of plant breeding for food use</u> ¹⁵²	Unklar
Kartoffel	CRISPR	Reduzierter Gehalt an Glykoalkaloiden (u. a. Solanin)	Simplot Plant Sciences (USA)	APHIS-Bescheid 2020. ¹⁵³ Kommerzialisierung geplant <u>Vermutlich werden auch diese Kartoffeln unter der Marke „Innate“ vertrieben.</u> ¹⁵⁴	Unklar

¹⁵⁰ https://www.aphis.usda.gov/biotechnology/downloads/reg_loi/20-168-06_air_inquiry_cbidel.pdf, https://www.aphis.usda.gov/biotechnology/downloads/reg_loi/20-168-06_air_response_signed.pdf

¹⁵¹ <https://www.potatopro.com/brands/innate-potatoes>

¹⁵² <https://www.canada.ca/en/health-canada/services/food-nutrition/genetically-modified-foods-other-novel-foods/transparency-initiative/list-non-novel-products-plant-breeding-food-use.html>

¹⁵³ https://www.aphis.usda.gov/biotechnology/downloads/reg_loi/20-168-02_air_inquiry_cbidel.pdf,
https://www.aphis.usda.gov/biotechnology/downloads/reg_loi/20-168-02_air_response_signed.pdf

¹⁵⁴ <https://www.potatopro.com/brands/innate-potatoes>

Kultur	Verfahren ^{a)}	Eigenschaften	Unternehmen ^{b)}	Entwicklungs-status ^{c)}	Freisetzungs- versuche
Kartoffel	CRISPR	Erzeugung von Selbstinkompatibilität	Simplot Plant Sciences (USA)	APHIS-Bescheid 2020. ¹⁵⁵ Kommerzialisierung geplant <u>Vermutlich werden auch diese Kartoffeln unter der Marke „Innate“ vertrieben.</u> ¹⁵⁶	Unklar
Kartoffel	CRISPR	Erhöhter Ertrag (Knollenbildung)	Simplot Plant Sciences (USA), Yield10Bioscience (USA) Extended Simplot research license ¹⁵⁷	APHIS-Bescheid 2020. Kommerzialisierung geplant. Seit 2019 Forschungszusammenarbeit mit Yield10Bioscience “to evaluate three novel yield traits in potato.” Unklar, ob diese traits hier Verwendung finden. ¹⁵⁸ <u>Vermutlich werden auch diese Kartoffeln unter der Marke „Innate“ vertrieben.</u> ¹⁵⁹	Unklar

155 https://www.aphis.usda.gov/biotechnology/downloads/reg_loi/20-168-34_air_inquiry_cbidel_a1.pdf,
https://www.aphis.usda.gov/biotechnology/downloads/reg_loi/20-168-34_air_response_signed.pdf

156 <https://www.potatopro.com/brands/innate-potatoes>

157 <https://ir.yield10bio.com/static-files/5e2cb123-1be6-40cf-9a56-1d90f2bfb52a>

158 <https://ir.yield10bio.com/static-files/cb2ac804-60e9-440c-8b91-b449941643a3>, <https://www.agribusinessglobal.com/agrochemicals/seeds-traits/yield10-bioscience-simplot-partner-to-evaluate-gene-editing-in-potatoes/>

159 <https://www.potatopro.com/brands/innate-potatoes>

Kultur	Verfahren ^{a)}	Eigenschaften	Unternehmen ^{b)}	Entwicklungs-status ^{c)}	Freisetzungs- versuche
Kartoffel	CRISPR	Verbesserte Lagereigenschaften bei kühlen Temperaturen (reduzierte vakuoläre Invertasen)	Simplot Plant Sciences (USA)	APHIS-Bescheid 2020. ¹⁶⁰ Kommerzialisierung geplant. <u>Vermutlich werden auch diese Kartoffeln unter der Marke „Innate“ vertrieben.</u> ¹⁶¹	Unklar
Kartoffel	CRISPR	<u>Non-browning potato</u> <u>Zwei weitere Traits: Acrylamide suppressed potatoes und Solanine supressed potato (beide zwischen Phase I und II)</u>	ToolGen Inc. (KOR)	Zwischen Phase II und Phase III. <u>Keine Änderung 2024.</u> ¹⁶²	Unklar

¹⁶⁰ https://www.aphis.usda.gov/biotechnology/downloads/reg_loi/20-168-33_air_inquiry_a1_cbidel.pdf,
https://www.aphis.usda.gov/biotechnology/downloads/reg_loi/20-168-33_air_response_signed.pdf

¹⁶¹ <https://www.potatopro.com/brands/innate-potatoes>

¹⁶² <http://www.toolgen.com/eng/crops>

Kultur	Verfahren ^{a)}	Eigenschaften	Unternehmen ^{b)}	Entwicklungs-status ^{c)}	Freisetzungs-versuche
Kartoffel	Genome-Editing (Ohne weitere Spezifizierung) <u>Boosted Breeding</u> ^{TM 163}	The potato was modified to alter the tuber sugar profile via reduction or loss of vacuolar invertase gene expression, resulting in decreased vacuolar invertase protein expression and less hydrolysis of sucrose to glucose and fructose	Ohalo Genetics Inc. (USA) ¹⁶⁴	APHIS-Bescheid 2023 ¹⁶⁵ (Antrag auf Überprüfung des Regulierungsstatus) Ohalo was operating under stealth for the past four years. ¹⁶⁶ <u>For potatoes, Ohalo plans to breed and develop potato lines and produce seeds. "How we go to market will vary depending on the class of the potato and the market that we're operating in."</u> ¹⁶⁷	Unklar

163 <https://www.potatonewstoday.com/2024/05/23/new-era-in-plant-breeding-ohalos-boosted-breeding-technology-a-game-changer-for-global-agriculture/>

164 <https://ohalogenetics.com/>

165 <https://www.aphis.usda.gov/brs/pdf/rsr/23-081-01rsr-submission.pdf>, <https://www.aphis.usda.gov/brs/pdf/rsr/23-081-01rsr-review-response.pdf>

166 <https://thespoon.tech/gene-edited-food-startup-ohalo-emerges-from-stealth-as-agtech-pioneer-dave-friedberg-takes-the-helm/>, siehe auch: <https://synthetic.com/ohalo-genetics-emerges-from-stealth/>

167 <https://agfundernews.com/armed-with-100m-in-funding-dave-friedberg-unveils-boosted-breeding-tech-at-ohalo-in-holy-shit-moment-for-crop-breeders>

Kultur	Verfahren ^{a)}	Eigenschaften	Unternehmen ^{b)}	Entwicklungs-status ^{c)}	Freisetzungs-versuche
Kartoffel	Genome-Editing (Ohne weitere Spezifizierung) <u>Boosted Breeding</u> ^{TM 168}	Erhöhte Konzentration von Beta-Carotin	Ohalo Genetics Inc. (USA) ¹⁶⁹	APHIS-Bescheid 2023 ¹⁷⁰ (Antrag auf Überprüfung des Regulierungsstatus) Ohalo was operating under stealth for the past four years. <u>For potatoes, Ohalo plans to breed and develop potato lines and produce seeds. "How we go to market will vary depending on the class of the potato and the market that we're operating in."</u> ¹⁷¹	Unklar

168 <https://www.potatonewstoday.com/2024/05/23/new-era-in-plant-breeding-ohalos-boosted-breeding-technology-a-game-changer-for-global-agriculture/>

169 <https://ohalogenetics.com/>

170 <https://www.aphis.usda.gov/brs/pdf/rsr/22-224-01rsr-review-submission.pdf>, <https://www.aphis.usda.gov/brs/pdf/rsr/22-224-01rsr-review-response.pdf>

171 <https://agfundernews.com/armed-with-100m-in-funding-dave-friedberg-unveils-boosted-breeding-tech-at-ohalo-in-holy-shit-moment-for-crop-breeders>

Kultur	Verfahren ^{a)}	Eigenschaften	Unternehmen ^{b)}	Entwicklungs-status ^{c)}	Freisetzungs- versuche
Kartoffel	CRISPR	Non-browning ¹⁷²	Instituto Nacional de Tecnología Agropecuaria (INTA) (ARG)	This GE potato is already in its second field trial as requested by INASE, and will enter the varietal registry after the third field trial.¹⁷³ The edited potato has already been submitted to the Instancia de Consulta Previa before the Argentine regulatory authority, which concluded that the product is considered conventional because it does not have genes from other distant organisms, which means that the potato should not follow the regulatory framework designated for transgenic crops.¹⁷⁴	Ja
Tomate NEU	CRISPR	Erhöhter Vitamin-D3-Gehalt	Bayer CropScience (DEU), G+FLAS (KOR)	In der Zusammenarbeit mit G+FLAS soll ihre Genomeditierungstechnologie genutzt und mit dem Genmaterial und der Expertise von Bayer kombiniert werden ¹⁷⁵	Nein

172 https://repositorio.inta.gob.ar/bitstream/handle/20.500.12123/9298/INTA_CRBsAsSur_EEABalcarce_Gonzalez-MN_Comparative_analysis_delivery.pdf?sequence=1&isAllowed=y

173 <https://allianceforscience.org/blog/2023/02/latin-america-a-biotech-laboratory-and-world-champion-in-gmos-and-gene-editing/>,

174 <https://www.potatobusiness.com/agro-news/the-argentinian-inta-is-close-to-releasing-the-first-latin-american-genetically-edited-potato/>

175 <https://www.bayer.com/media/bayer-nutzt-genomeditierung-fuer-naehrstoffreicheres-gemuese/>, <https://www.wired.com/story/gene-edited-salad-greens-fall-pairwise-bayer-crispr-gmo/>, <https://www.fruitnet.com/asiafruit/bayer-ag-and-gflas-partner-to-develop-enhanced-tomatoes/257609.article>

Kultur	Verfahren ^{a)}	Eigenschaften	Unternehmen ^{b)}	Entwicklungs- status ^{c)}	Freisetzungs- versuche
Tomate	CRISPR (Cas-Enzym undeclariert, patentiert von Inari) Inari nutzt Genome Editing wohl für Multiplexing. Sie haben dazu 2022 ein White Paper veröffentlicht. ¹⁷⁶	Keine Angabe (<i>Confidential Business Information</i>)	Inari Agriculture Inc. (USA)	APHIS-Bescheid 2020. Kommerzialisierung geplant. ¹⁷⁷ Unklar, ob Inari noch an Tomaten arbeitet. Der Schwerpunkt liegt auf Weizen, Soja und Mais. Auf der Seite des WEF wird behauptet: Inari has already delivered over 90% productivity in tomatoes. ¹⁷⁸	Unklar

¹⁷⁶ https://inari.com/remote-media/Multiplex-Gene-Editing-White-Paper_11-2022.pdf

¹⁷⁷ <https://inari.com/news/inari-and-becks-announce-strategic-collaboration-to-accelerate-farmer-access-to-gene-editing-innovation>

¹⁷⁸ <https://www.weforum.org/organizations/inari-agriculture>

Kultur	Verfahren ^{a)}	Eigenschaften	Unternehmen ^{b)}	Entwicklungs-status ^{c)}	Freisetzungs- versuche
Tomate Im Anbau Sicilian Rouge high GABA	CRISPR Matsuo M and Tachikawa M (2022): Implications and Lessons From the Introduction of Genome-Edited Food Products in Japan. Front. Genome Ed. ¹⁷⁹	Erhöhter Gehalt an Gamma-Amino-Buttersäure (GABA) The Sicilian Rouge High GABA tomato, developed by Sanatech Seed Co.,Ltd., was accepted by the Consumer Affairs Agency (CAA) as a food with functional claim on 30 November 2022 (Notification: H617) ¹⁸⁰	Sanatech Seed (JPN) “Sanatech first tested the appetite of consumers in Japan for the genome-edited fruit in May 2021 when it sent free seedling CRISPR-edited tomato plants to about 4,200 home gardeners who had requested them.”	APHIS-Bescheid 2020. Zulassung Japan Dezember 2020. Kommerzialisierung in Japan seit Frühjahr 2021. “Encouraged by the positive demand, the company started direct internet sales of fresh tomatoes in September and a month later took orders for seedlings for next growing season.” ¹⁸¹ <u>High GABA Tomato Determined as Non-GM in the Philippines</u> ¹⁸² <u>At a May 28 event in the Netherlands, Sanatech president Shimpei Takeshita said the company has expanded distribution in Japan and has completed all the regulatory paperwork to introduce its tomato in the Philippines. It's also looking to bring its edited tomato to the US.</u> ¹⁸³	Ja

179 <https://fjfsdata01prod.blob.core.windows.net/articles/files/899154/pubmed-zip/.versions/2/.package-entries/fgeed-04-899154-r1/fgeed-04-899154.pdf?sv=2018-03-28&sr=b&sig=fqDr9c%2Fe8iDDc6jrJ%2BqgrJ2%2BSr4HwdfF7UCe7SVpcUM%3D&se=2022-12-19T08%3A04%3A30Z&sp=r&scd=attachment%3B%20filename%2A%3DUTF-8%27%27fgeed-04-899154.pdf>

180 <https://sanatech-seed.com/en/221226-2/>

181 <https://www.nature.com/articles/d41587-021-00026-2>, <https://www.isaaa.org/kc/cropbiotechupdate/article/default.asp?ID=19024>

182 <https://www.isaaa.org/kc/cropbiotechupdate/ged/article/default.asp?ID=20831>

183 <https://www.wired.com/story/gene-edited-salad-greens-fall-pairwise-bayer-crispr-gmo/>

Kultur	Verfahren ^{a)}	Eigenschaften	Unternehmen ^{b)}	Entwicklungs-status ^{c)}	Freisetzungs- versuche
Paprika	CRISPR	Trockenheits- toleranz	ToolGen Inc. (KOR)	Zwischen Phase I und Phase II. <u>Keine Änderung 2024.</u> ¹⁸⁴	Unklar
Chinakohl	CRISPR	Soft rot tolerant	ToolGen Inc. (KOR)	Zwischen Phase I und Phase II. ¹⁸⁵ <u>Keine Änderung 2024.</u> ¹⁸⁶	Unklar
Avocado	Genome Editing – ohne weitere Angaben	Unklar („ <i>Confidential Business Information</i> “) Vermutlich non- browning	GreenVenus (USA) Firmenausgründung von Intrexon, die den nicht-bräunenden GreenVenus™-Salat entwickelt haben ¹⁸⁷	APHIS-Bescheid 2020. ¹⁸⁸ Kommerzialisierung geplant. Mai 2023: GV announces a groundbreaking achievement in avocado gene editing and plant regeneration. GreenVenus's scientists have successfully modified a key gene associated with fruit browning, opening new possibilities for producing higher- quality avocados. ¹⁸⁹	Unklar

184 <http://www.toolgen.com/eng/crops>

185 http://www.toolgen.com/eng/business/business_04.jsp

186 <http://www.toolgen.com/eng/crops>

187 <http://www.greenvenus.com/#news>

188 https://www.aphis.usda.gov/biotechnology/downloads/reg_loi/20-163-01_air_inquiry_a1_cbidel.pdf,
https://www.aphis.usda.gov/biotechnology/downloads/reg_loi/20-163-01_air_response_signed.pdf

189 <https://www.greenvenus.com/wp-content/uploads/2023/06/GreenVenus-LLC-Achieves-Breakthrough-in-Avocado-Gene-Editing.pdf>,
<https://podcasts.apple.com/us/podcast/happy-green-guacamole-the-non-browning-avocado-dr/id1006329802?i=1000617338808>

Kultur	Verfahren ^{a)}	Eigenschaften	Unternehmen ^{b)}	Entwicklungs-status ^{c)}	Freisetzungs-versuche
Avocado	CRISPR	Non-browning	J. R. Simplot (USA)	APHIS-Bescheid 2020. ¹⁹⁰ Kommerzialisierung geplant	Unklar
Erdbeere S4A	CRISPR	Remontierende Erdbeere/mehr Ertrag durch 2x Blüte-/Fruchtbildung	J. R. Simplot (USA), ev. mit Plant Sciences Inc. (PSI) (USA)	APHIS-Bescheid 2020. ¹⁹¹ Kommerzialisierung geplant <u>Markteinführung: 2025</u> <u>Aufgeführt auf der Kanadischen List of non-novel products of plant breeding for food use</u> ¹⁹²	Ja

¹⁹⁰ https://www.aphis.usda.gov/biotechnology/downloads/reg_loi/20-168-35_air_inquiry_a2_cbidel.pdf,
https://www.aphis.usda.gov/biotechnology/downloads/reg_loi/20-168-35_air_response_signed.pdf

¹⁹¹ https://www.aphis.usda.gov/biotechnology/downloads/reg_loi/20-168-05_air_inquiry_a1_cbidel.pdf,
https://www.aphis.usda.gov/biotechnology/downloads/reg_loi/20-168-05_air_response_signed.pdf

¹⁹² <https://www.canada.ca/en/health-canada/services/food-nutrition/genetically-modified-foods-other-novel-foods/transparency-initiative/list-non-novel-products-plant-breeding-food-use.html>

Kultur	Verfahren ^{a)}	Eigenschaften	Unternehmen ^{b)}	Entwicklungs-status ^{c)}	Freisetzungs- versuche
Erdbeere	CRISPR	Improved shelf life	J. R. Simplot (USA), Plant Sciences Inc. (PSI) (USA)	“We expect to launch the first commercially available, gene edited strawberry in the coming years. PSI will provide its proprietary strawberry germplasm, plant growing expertise, and lead the commercialization of successful varieties.”¹⁹³ Through our collaboration with Simplot, we are implementing gene editing across all of our strawberry breeding programs to bring to market fruit with traits that would otherwise take a lifetime to achieve through traditional breeding methods.¹⁹⁴	Nein
Erdbeere NEU	Genome-Editing (Ohne weitere Spezifizierung) Boosted Breeding ^{TM 195}	Krankheitsresistenz (Neopestalotiopsis)	Ohaolo Genetics Inc. (USA) ¹⁹⁶ , Institute of Food and Agricultural Sciences, University of Florida (USA), Florida Foundation Seed Producers Inc., Florida Strawberry Growers Association (FSGA)	Aim is to combat the serious threat of neopestalotiopsis in strawberries. This collaboration aims to develop innovative solutions to protect and enhance strawberry production, leveraging Ohaolo's cutting-edge breeding technology.	Nein

193 <https://simplot.com/company/news/j-r-simplot-company-and-plant-sciences-inc>

194 <https://plantsciences.com/>

195 <https://www.potatonewstoday.com/2024/05/23/new-era-in-plant-breeding-ohalos-boosted-breeding-technology-a-game-changer-for-global-agriculture/>

196 <https://ohalogenetics.com/>

Kultur	Verfahren ^{a)}	Eigenschaften	Unternehmen ^{b)}	Entwicklungs-status ^{c)}	Freisetzungs- versuche
Brombeere, Himbeere	CRISPR	Kernlose Brombeeren Weitere traits in Arbeit: Stachellosigkeit, kompakter Wuchs 2024: Pairwise meldet Durchbruch bei der Entwicklung: We're excited to advance these berries into the next phase of product development, including outdoor field trials, as we work toward scaling up and making them available to the public in a few years. ¹⁹⁷	Pairwise Plants (USA), Plant Sciences Inc. (USA) Partnership with the USDA, N.C. State University and some other universities to study the genetics of caneberries (i.e. blackberries and raspberries) ¹⁹⁸ Kooperation mit North Carolina State University ¹⁹⁹	2022: 2x APHIS-Bescheide (Confirmation letters) ²⁰⁰ 2023: 8x APHIS-Bescheide (Confirmation letters) ²⁰¹ 2024: Pairwise has received confirmation of nine new regulatory exemptions from the U.S. Department of Agriculture (USDA) for gene-edited blackberries and black raspberries. ²⁰²	Geplant

197 <https://www.pairwise.com/news/pairwise-develops-first-seedless-blackberry>, <https://www.isaaa.org/kc/cropbiotechupdate/ged/article/default.asp?ID=20879>

198 <https://www.growingproduce.com/fruits/is-gene-editing-the-new-horizon-for-berry-crop-improvement/>

199 <https://www.pairwise.com/news/pairwise-collaborates-with-north-carolina-state-university-on-caneberry-research>

200 <https://www.aphis.usda.gov/biotechnology/downloads/confirmation-response/22-213-01cr-request.pdf>,
<https://www.aphis.usda.gov/biotechnology/downloads/confirmation-response/22-213-03cr-request.pdf>

201 Beispieldokumente: <https://www.aphis.usda.gov/biotechnology/downloads/confirmation-response/23-072-08cr-request.pdf>,
<https://www.aphis.usda.gov/biotechnology/downloads/confirmation-response/23-072-08cr-signed-response.pdf>,
<https://www.aphis.usda.gov/aphis/ourfocus/biotechnology/regulatory-processes/confirmations/responses/cr-table>

202 <https://www.isaaa.org/kc/cropbiotechupdate/ged/article/default.asp?ID=20620>, <https://www.aphis.usda.gov/sites/default/files/24-024-01cr-request.pdf>,
<https://www.aphis.usda.gov/sites/default/files/24-024-01cr-response.pdf>

Kultur	Verfahren ^{a)}	Eigenschaften	Unternehmen ^{b)}	Entwicklungs-status ^{c)}	Freisetzungs-versuche
Banane	GEiGS® (Gene-editing, RNAi) ²⁰³	Verlängertes Shelf-life	Tropic Bioscience (GBR)	With the new round of funding, the company, which was founded in 2016, will begin testing its new varieties globally. ²⁰⁴ APHIS-Bescheid (Confirmation letter) ²⁰⁵	Ja
Banane	GEiGS® (Gene-editing, RNAi)	Resistenz gegen TR4	Tropic Bioscience (GBR)	Tropic has ambitious plans to expand its current field trials significantly throughout 2023. They aim to reach additional countries across Latin America and the Philippines, bringing the transformative power of GEiGS® to more farmers and communities. By doing so, Tropic strives to eradicate TR4 and other devastating diseases, heralding a new era of sustainable agriculture. ²⁰⁶	Ja (<u>Honduras</u>) ²⁰⁷

203 <https://www.geigs.com/>

204 <https://www.geigs.com/>

205 <https://www.aphis.usda.gov/biotechnology/downloads/confirmation-response/21-356-01cr-cbidel-a4.pdf>

206 <https://tropic.bio/empowering-growers-with-a-sustainable-solution-against-banana-panama-disease-tr4/>

207 <https://tropic.bio/empowering-growers-with-a-sustainable-solution-against-banana-panama-disease-tr4/>

Kultur	Verfahren ^{a)}	Eigenschaften	Unternehmen ^{b)}	Entwicklungs-status ^{c)}	Freisetzungs-versuche
Banane TRB011001 TRB011002 Vor-kommerzieller Anbau	GEiGS® (Gene-editing (CRISPR), RNAi)	Non-browning	Tropic Bioscience (GBR)	APHIS-Bescheid 2023 ²⁰⁸ (Antrag auf Überprüfung des Regulierungsstatus) May 2023: the Philippines have given the non-browning banana from tropic a non-GMO exemption. This crop can now be imported and propagated freely in the Philippines. ²⁰⁹ <u>The banana varieties with improved reduced-browning characteristics have been determined as non-genetically modified organisms (GMOs) in the Philippines.</u> ²¹⁰	Ja
Banane NEU	ARCUS® genome-editing technology	Krankheitsresistenz	Elo Life Sciences (USA), Dole (USA) ²¹¹ (Tochtergesellschaft von Precision BioScience)	The company, a 2021 spin-off of Precision BioSciences, is also working with Dole on fungal-resistant cavendish banana to save the popular variety from extinction ²¹²	Nein

208 <https://www.aphis.usda.gov/brs/pdf/rsr/22-238-01rsr-submission.pdf>, <https://www.aphis.usda.gov/brs/pdf/rsr/22-238-01rsr-review-response.pdf>

209 <https://tropic.bio/tropics-non-browning-gene-edited-banana-cleared-for-production-in-the-philippines/>

210 <https://www.isaaa.org/kc/cropbiotechupdate/article/default.asp?ID=20882>

211 <https://elolife.com/what-we-do/food-protection-productivity-partnerships/>

212 <https://elolife.com/news/npr-deadly-fungus-is-threatening-bananas-one-company-is-trying-to-save-the-fruit-through-gene-editing/>

Kultur	Verfahren ^{a)}	Eigenschaften	Unternehmen ^{b)}	Entwicklungs- status ^{c)}	Freisetzungs- versuche
Orange	CRISPR	Toleranz gegen Zitruskrebs (<i>Xanthomonas citri</i>)	Soil Culture Solutions, LLC (Soilcea) (USA)	APHIS-Bescheid 2020 2021: Neue Forschungsgelder erhalten ²¹³ Soilcea is in the process of partnering with growers and nurseries to rapidly test and distribute the edited trees. ²¹⁴ <u>Neuer APHIS-Bescheid 2024²¹⁵</u>	Geplant

²¹³ <https://www.sbir.gov/node/2082193>

²¹⁴ <https://www.aiche.org/resources/publications/cep/2022/july/catalyzing-commercialization-gene-editing-promises-new-disease-resistant-citrus-trees>

²¹⁵ <https://www.aphis.usda.gov/sites/default/files/23-132-02rsr.pdf>, <https://www.aphis.usda.gov/sites/default/files/23-132-02rsr-response.pdf>,
<https://citrusindustry.net/2024/11/06/soilcea-modified-sweet-orange-receives-favorable-decision/>

Kultur	Verfahren ^{a)}	Eigenschaften	Unternehmen ^{b)}	Entwicklungs- status ^{c)}	Freisetzungs- versuche
Weintraube Im Anbau <u>GreenVenus' new Colombard and Malbec grape varieties are currently available for planting to growers and winemakers through licensing agreements. In addition, the company will complete gene editing on Chardonnay, Sauvignon Blanc, Grenache and Gruner Veltliner later this year and Cabernet Sauvignon, Cabernet Franc, Pinot Noir and Zinfandel by this time next year.</u> ²¹⁶	CRISPR	Wine grape cultivars that possess natural preservation properties, diminishing or negating the need for sulfites as preservatives during winemaking.	GreenVenus (USA)	The achievement resulted from a collaboration between GreenVenus and the Ralph M. Parsons Foundation Plant Transformation Facility in the College of Agriculture and Environmental Sciences at UC Davis, who developed a breakthrough platform that allows for the regeneration of gene-edited plants from single cells of multiple grape varieties. ²¹⁷	Ja

²¹⁶ https://www.wineindustrynetwork.com/c/greenvenus?utm_source=wineindustrynetwork.com&utm_medium=website

²¹⁷ <https://www.greenvenus.com/wp-content/uploads/2023/08/GreenVenus-Improves-Wine-Grape-Genetics.pdf>

Kultur	Verfahren ^{a)}	Eigenschaften	Unternehmen ^{b)}	Entwicklungs-status ^{c)}	Freisetzungs-versuche
Wassermelone (& andere Melonenarten)	ARCUS® genome-editing technology <i>We figured out a way to take that pathway from the monk fruit [that produces the sweet component mogroside V, a triterpenoid glycoside 200-300 times sweeter than sucrose] and put it into crops that you can grow in your backyard.</i>	Natürlicher Süßstoff auf Wassermelonen-Basis <u>Markteinführung 2026 geplant</u>²¹⁸	Elo Life Sciences (USA) (Tochtergesellschaft von Precision BioScience)²¹⁹ “Melon is our bio factory for the first generation of our sweetener, but... there are some other crops that we’re thinking through that that might be of interest [as biofactories]”²²⁰	Elo achieved proof of concept with its ZeroMelon™ watermelon-based sweetener program and advanced the program to greenhouse trials. This program is intended to leverage ARCUS to develop a scalable low-calorie sweetener.²²¹ Elo hat für das Projekt neue Gelder eingeworben.²²²	Gewächshaus

218 <https://www.foodbusinessnews.net/articles/26853-delivering-sweetness-without-the-sugar>

219 <https://investor.precisionbiosciences.com/news-releases/news-release-details/precision-biosciences-completes-spin-out-elo-life-systems/>

220 <https://www.foodnavigator-usa.com/Article/2022/09/09/Elo-to-commercialize-new-high-intensity-plant-based-sweetener-in-2025-with-sweeter-cleaner-taste-than-monk-fruit-extracts>

221 <https://elolife.com/what-we-do/healthy-and-nutritious-ingredients/>

222 <https://vegconomist.com/investments-finance/elo-series-a-sweetener-watermelons/>

Kultur	Verfahren ^{a)}	Eigenschaften	Unternehmen ^{b)}	Entwicklungs- status ^{c)}	Freisetzungs- versuche
Leindotter	CRISPR (Multiplexing)	Erhöhter Ölgehalt Trait C3007, C3010, C3012 <u>Oil-enhancing traits can produce an increase in oil content in individual seeds as well as an increase in seed oil content as a percentage of seed weight, as compared to control plants</u>²²³	Yield10 Bioscience (USA), University of Missouri (USA) <u>Yield10 Bioscience, Inc. hat einen Insolvenzantrag gestellt, der es dem Unternehmen ermöglicht, als „Schuldner in Besitz“ zu agieren, während es die gerichtliche Genehmigung von Anträgen zur Aufrechterhaltung des Geschäftsbetriebs beantragt. Das Unternehmen plant, die meisten seiner Vermögenswerte während des Konkursverfahrens zu veräußern.</u>²²⁴	APHIS-Bescheid 2020	Ja

²²³ <https://www.yield10bio.com/crop-science/novel-crop-traits>

²²⁴ <https://de.marketscreener.com/kurs/aktie/YIELD10-BIOSCIENCE-INC-39016366/news/Yield10-Bioscience-Inc-hat-Konkurs-angemeldet-48543779/>

Kultur	Verfahren ^{a)}	Eigenschaften	Unternehmen ^{b)}	Entwicklungs-status ^{c)}	Freisetzungs-versuche
Leindotter Vor-kommerzieller Anbau	CRISPR (Multiplexing) „the triple-edited Camelina plant lines are based on an oil biosynthesis pathway engineered directly into the plant – all based upon CRISPR genome editing.“	Erhöhter Ölgehalt The Camelina line we have designated E3902 contains CRISPR edits of C3008a, C3008b and C3009	Yield10 Bioscience (USA) <u>Yield10 Bioscience, Inc. hat einen Insolvenzantrag gestellt, der es dem Unternehmen ermöglicht, als „Schuldner in Besitz“ zu agieren, während es die gerichtliche Genehmigung von Anträgen zur Aufrechterhaltung des Geschäftsbetriebs beantragt. Das Unternehmen plant, die meisten seiner Vermögenswerte während des Konkursverfahrens zu veräußern.</u> ²²⁵	APHIS-Bescheid 2018 Zulassung Argentinien (2021) ²²⁶ <u>Zulassung Chile (2022)</u> <u>Zulassung Kanada (2024)</u> ²²⁷	Ja

225 <https://de.marketscreener.com/kurs/aktie/YIELD10-BIOSCIENCE-INC-39016366/news/Yield10-Bioscience-Inc-hat-Konkurs-angemeldet-48543779/>

226 https://www.seedquest.com/news.php?type=news&id_article=135132&id_region=&id_category=&id_crop=

227 https://www.seedquest.com/news.php?type=news&id_article=153430&id_region=&id_category=2450&id_crop=

Kultur	Verfahren ^{a)}	Eigenschaften	Unternehmen ^{b)}	Entwicklungs- status ^{c)}	Freisetzungs- versuche
Leindotter	CRISPR	Erhöhter Ertrag Trait C3003, C3004 C3003 is an algal gene, in-licensed from the University of Massachusetts. Based on our research, C3004 in Camelina resulted in a significant increase in plant growth and vigor, increased branching and seed yield, and in some cases, increased individual seed weight.	Yield10 Bioscience (USA) <u>Yield10 Bioscience, Inc. hat einen Insolvenzantrag gestellt, der es dem Unternehmen ermöglicht, als „Schuldner in Besitz“ zu agieren, während es die gerichtliche Genehmigung von Anträgen zur Aufrechterhaltung des Geschäftsbetriebs beantragt. Das Unternehmen plant, die meisten seiner Vermögenswerte während des Konkursverfahrens zu veräußern.</u>²²⁸	Yield10Bioscience hat 2021 einen Nichtregulierungsbescheid der APHIS für Leindotter-Linien erhalten. Unklar, um welche Linien mit welchen Eigenschaften es sich handelt (CBI).²²⁹	Ja

²²⁸ <https://de.marketscreener.com/kurs/aktie/YIELD10-BIOSCIENCE-INC-39016366/news/Yield10-Bioscience-Inc-hat-Konkurs-angemeldet-48543779/>

²²⁹ https://www.aphis.usda.gov/biotechnology/downloads/confirmation-response/20-358-01cr_request_cbidel_a2.pdf,
https://www.aphis.usda.gov/biotechnology/downloads/confirmation-response/20-358-01cr_response_signed.pdf

Kultur	Verfahren ^{a)}	Eigenschaften	Unternehmen ^{b)}	Entwicklungs-status ^{c)}	Freisetzungs-versuche
Leindotter Vor-kommerzieller Anbau	CRISPR <u>Innovation & Research des Traits durch Rothamsted Research.</u> <u>Juni 2024: Rothamsted Research Grants Yield10 Bioscience an Exclusive, Global Commercial License to Advanced Technology for Producing Omega-3 Products in Camelina</u> ²³⁰	Erhöhter Ölgehalt (Omega-3-Fettsäure) <u>July 2024: License Agreement with Nuseed Nutritional US Inc., granting Nufarm a commercial license to certain Omega-3 intellectual property assets, materials and know-how for producing oil in Camelina.</u> ²³¹	Rothamsted Research (GBR), Yield10Bioscience (USA), Nufarm US Inc. (USA) <u>Yield10 Bioscience, Inc. hat einen Insolvenzantrag gestellt, der es dem Unternehmen ermöglicht, als „Schuldner in Besitz“ zu agieren, während es die gerichtliche Genehmigung von Anträgen zur Aufrechterhaltung des Geschäftsbetriebs beantragt. Das Unternehmen plant, die meisten seiner Vermögenswerte während des Konkursverfahrens zu veräußern.</u> ²³²	Yield10Bioscience plant Markteinführung in Chile. ²³³ Yield 10 B. filed a request for a Regulatory Status Review (“RSR”) with USDA-APHIS Biotechnology Regulatory Services (“BRS”) under “SECURE” Rule for proprietary elite Camelina sativa (“Camelina”) varieties designed to produce seed oil containing both essential omega-3 fatty acids eicosapentaenoic acid (“EPA”) and docosahexaenoic acid (“DHA”). ²³⁴ <u>APHIS-Bescheid 2024.</u> ²³⁵ <u>Initial ramping up of seed production of camelina lines with the trait have begun in US and Chile, with potential for the crop to be grown both as a cash and a cover crop.</u> ²³⁶	Ja, GBR seit 2018 Verlängert bis 2023 A number of these Camelina lines have been successfully field-tested for four years at different locations in the UK, Canada, and the US, and oil samples have been produced for salmon and human feeding studies.

²³⁰ <https://www.yield10bio.com/press/yield10-signs-commercial-license-with-rothamsted-for-o-3>

²³¹ <https://www.yield10bio.com/press/yield10-bioscience-grants-nufarm-a-commercial-license-to-omega-3-assets-for-producing-oil-in-camelina-and-yield10-and-nufarm-sign-a-memorandum-of-understanding-for-sale-of-assets>

²³² <https://de.marketscreener.com/kurs/aktie/YIELD10-BIOSCIENCE-INC-39016366/news/Yield10-Bioscience-Inc-hat-Konkurs-angemeldet-48543779/>

²³³ <https://ir.yield10bio.com/static-files/cb2ac804-60e9-440c-8b91-b449941643a3>

²³⁴ <https://www.yield10bio.com/press/yield10-bioscience-files-request-for-regulatory-status-review-with-usda-aphis-for-camelina-designed-to-produce-the-epa-and-dha-components-of-omega-3-oil>

Kultur	Verfahren ^{a)}	Eigenschaften	Unternehmen ^{b)}	Entwicklungs-status ^{c)}	Freisetzungs- versuche
Leindotter NEU	CRISPR	Erhöhter Ölgehalt (Omega-3-Fettsäure) Öl soll v. a. in Aquakulturen als Futter eingesetzt werden Over the next year, Yield10 expects to scale-up planted acres of Camelina to supply BioMar with oil for formulation and testing while also working towards securing regulatory approval for commercial production of Omega-3 Camelina oil and meal in the targeted production geographies.	Rothamsted Research (GBR), Yield10Bioscience (USA), Nufarm US Inc. (USA), BioMar Group (DNK)²³⁷ Yield10 Bioscience, Inc. hat einen Insolvenzantrag gestellt, der es dem Unternehmen ermöglicht, als „Schuldner in Besitz“ zu agieren, während es die gerichtliche Genehmigung von Anträgen zur Aufrechterhaltung des Geschäftsbetriebs beantragt. Das Unternehmen plant, die meisten seiner Vermögenswerte während des Konkursverfahrens zu veräußern.²³⁸	October 2023, Yield10 announced it had signed a non-binding Letter of Intent (“LOI”) with BioMar Group, a global aquafeed producer, to form a partnership to commercialize Camelina engineered to produce omega-3 oil for use as a high-quality supplement to the scarce supply of marine long-chain fatty acids used in aquafeed. 2023: APHIS application for Camelina engineered to produce omega-3 oil containing both EPA and DHA fatty acids. APHIS-Bescheid 2024.	Ja

235 <https://www.yield10bio.com/press/usda-aphis-determines-yield10-biosciences-omega-3-camelina-varieties-planted-bred-united-states>

236 <https://www.fwi.co.uk/machinery/technology/how-precision-breeding-act-is-helping-progress-gene-edited-crops>, <https://www.rothamsted.ac.uk/news/rothamsted-research-agrees-global-commercial-license-yield-10-bioscience-produce-omega-3>

237 <https://www.biomar.com/insights/insights-hub/yield10-bioscience-and-biomar-aim-to-grow-fish-oil-on-land>

238 <https://de.marketscreener.com/kurs/aktie/YIELD10-BIOSCIENCE-INC-39016366/news/Yield10-Bioscience-Inc-hat-Konkurs-angemeldet-48543779/>

Kultur	Verfahren ^{a)}	Eigenschaften	Unternehmen ^{b)}	Entwicklungs-status ^{c)}	Freisetzungs-versuche
Leindotter	CRISPR	Nutzung als Bioplastik. Traits C3014 and C3015 The stability of Camelina seeds at ambient temperatures allows them to be readily harvested, transported, and stored prior to processing, making them the ideal site in a plant for producing PHA plastics.²³⁹	Yield10Bioscience (USA) <u>Yield10 Bioscience, Inc. hat einen Insolvenzantrag gestellt, der es dem Unternehmen ermöglicht, als „Schuldner in Besitz“ zu agieren, während es die gerichtliche Genehmigung von Anträgen zur Aufrechterhaltung des Geschäftsbetriebs beantragt. Das Unternehmen plant, die meisten seiner Vermögenswerte während des Konkursverfahrens zu veräußern.</u>²⁴⁰	Forschung & Entwicklung “Yield10 designed traits C3014 and C3015 to produce PHA bioplastic as a third seed product in Camelina.”²⁴¹ “Biodegradable plastics could become more plentiful and cost-effective as Camelina plants are reprogrammed to produce a biodegradable material called polyhydroxyalkanoates, better known as PHAs”.	Ja “Yield10 is scaling up its two best PHA Camelina lines at sites in the U.S. and Canada. Results of field tests in 2020 achieved a proof-of-concept milestone for a plant-based route of production for PHA”.²⁴²

239 <https://www.yield10bio.com/crop-science/novel-crop-traits>

240 <https://de.marketscreener.com/kurs/aktie/YIELD10-BIOSCIENCE-INC-39016366/news/Yield10-Bioscience-Inc-hat-Konkurs-angemeldet-48543779/>

241 <https://www.yield10bio.com/crop-science/novel-crop-traits>, <https://ir.yield10bio.com/static-files/cb2ac804-60e9-440c-8b91-b449941643a3>

242 <https://finance.yahoo.com/news/yield10-bioscience-begins-2021-field-123000539.html>, <https://ir.yield10bio.com/node/15526/pdf>

Kultur	Verfahren ^{a)}	Eigenschaften	Unternehmen ^{b)}	Entwicklungs-status ^{c)}	Freisetzungs-versuche
Leindotter	CRISPR	C4000 Trait Series Using our Trait Factory, we have identified the C4004 to C4027 series of transcription factor genes that are down-regulated in our high-photosynthesis engineered switchgrass plants as well as several new gene targets related to our lead C3003 yield trait.	Yield10Bioscience (USA) <u>Yield10 Bioscience, Inc. hat einen Insolvenzantrag gestellt, der es dem Unternehmen ermöglicht, als „Schuldner in Besitz“ zu agieren, während es die gerichtliche Genehmigung von Anträgen zur Aufrechterhaltung des Geschäftsbetriebs beantragt. Das Unternehmen plant, die meisten seiner Vermögenswerte während des Konkursverfahrens zu veräußern.</u>²⁴³	We have proven that traits from the C4000 series can significantly increase photosynthetic efficiency, above-ground biomass, and below-ground biomass production in our switchgrass plants engineered to overexpress the transcription factors. The traits in this series and the proof points we are generating create partnership opportunities that enable us to further the development of these traits in major commercial food, feed, and forage crops.	Unklar

243 <https://de.marketscreener.com/kurs/aktie/YIELD10-BIOSCIENCE-INC-39016366/news/Yield10-Bioscience-Inc-hat-Konkurs-angemeldet-48543779/>

Kultur	Verfahren ^{a)}	Eigenschaften	Unternehmen ^{b)}	Entwicklungs- status ^{c)}	Freisetzungs- versuche
Leindotter	CRISPR Transgenese	Erhöhter Ölgehalt, Herbizidresistenz (Glufosinat) <u>Yield10 Bioscience Announces Addition of Camelina to INTERLINE® Herbicide Label</u> ²⁴⁴	Yield10 Bioscience (USA), Vision Bioenergy (USA) <u>Yield10 Bioscience, Inc. hat einen Insolvenzantrag gestellt, der es dem Unternehmen ermöglicht, als „Schuldner in Besitz“ zu agieren, während es die gerichtliche Genehmigung von Anträgen zur Aufrechterhaltung des Geschäftsbetriebs beantragt. Das Unternehmen plant, die meisten seiner Vermögenswerte während des Konkursverfahrens zu veräußern.</u> ²⁴⁵	APHIS-Bescheid 2022 ²⁴⁶ <u>Yield10 Bioscience Grants Global License to VISION Bioenergy Oilseeds for Herbicide Tolerant Camelina Cultivated for the Production of Biofuel Feedstock</u> ²⁴⁷	Ja <u>Yield10 Bioscience Reports that Proprietary Varieties of Winter Camelina Show Tolerance to Commonly Used Herbicides in First Field Tests</u> ²⁴⁸

244 <https://www.yield10bio.com/press/yield10-bioscience-announces-addition-of-camelina-to-interline-r-herbicide-label>

245 <https://de.marketscreener.com/kurs/aktie/YIELD10-BIOSCIENCE-INC-39016366/news/Yield10-Bioscience-Inc-hat-Konkurs-angemeldet-48543779/>

246 <https://www.aphis.usda.gov/brs/pdf/rsr/22-174-01rsr-submission.pdf>, <https://www.aphis.usda.gov/brs/pdf/rsr/22-174-01rsr-review-response.pdf>

247 <https://www.yield10bio.com/press/yield10-bioscience-grants-global-license-to-vision-bioenergy-oilseeds-for-herbicide-tolerant-camelina-cultivated-for-the-production-of-biofuel-feedstock>

248 <https://www.yield10bio.com/press/yield10-winter-camelina-proprietary-varieties-show-tolerance-commonly-used-herbicides>

Kultur	Verfahren ^{a)}	Eigenschaften	Unternehmen ^{b)}	Entwicklungs-status ^{c)}	Freisetzungs-versuche
Leindotter	CRISPR Transgenese	Erhöhter Ölgehalt, 2-fache Herbizidresistenz Sorten für Winter- und Frühjahrsanbau	Yield10 Bioscience (USA) <u>Yield10 Bioscience, Inc. hat einen Insolvenzantrag gestellt, der es dem Unternehmen ermöglicht, als „Schuldner in Besitz“ zu agieren, während es die gerichtliche Genehmigung von Anträgen zur Aufrechterhaltung des Geschäftsbetriebs beantragt. Das Unternehmen plant, die meisten seiner Vermögenswerte während des Konkursverfahrens zu veräußern.</u> ²⁴⁹	APHIS-Bescheid 2023 ²⁵⁰ (Antrag auf Überprüfung des Regulierungsstatus) Yield10 is developing stacked HT Camelina varieties with tolerance to the application of glufosinate, a Group 10 herbicide used to control broadleaf weeds, as well as tolerance to soil residues of Group 2 herbicides, specifically including tolerance to both imidazolinones (“IMIs”) and sulfonylureas (“SUs”). ²⁵¹	Ja Yield 10 Bioscience announced positive results in the first field test of stacked herbicide tolerance (“HT”) traits in Camelina.

249 <https://de.marketscreener.com/kurs/aktie/YIELD10-BIOSCIENCE-INC-39016366/news/Yield10-Bioscience-Inc-hat-Konkurs-angemeldet-48543779/>

250 <https://www.aphis.usda.gov/brs/pdf/rsr/23-096-01rsr-submission.pdf>, <https://www.aphis.usda.gov/brs/pdf/rsr/23-096-01rsr-review-response.pdf>

251 <https://www.yield10bio.com/press/usda-aphis-determines-that-yield10-biosciences-stacked-herbicide-tolerant-camelina-may-be-planted-and-bred-in-the-united-states>

Kultur	Verfahren ^{a)}	Eigenschaften	Unternehmen ^{b)}	Entwicklungs-status ^{c)}	Freisetzungs-versuche
Leindotter	CRISPR	High oil yield, quick maturity, herbicide tolerance,²⁵² drought tolerance, and other desirable traits Syngenta Seeds and Sustainable Oils, Inc. have entered into a new agreement to sell Camelina sativa (camelina) seed. Camelina seed will be sold through Syngenta's AgriPro® dealer network in a vertical marketing model.²⁵³	Sustainable Oils (USA), Kooperationen mit World Energy und ExxonMobil (USA), Syngenta Seeds (CHN) Tochtergesellschaft von Global Clean Energy Holdings Inc.²⁵⁴	August 2022: Sustainable Oils, Inc. announced a joint licensing agreement with Corteva Agriscience and the Broad Institute of MIT and Harvard for CRISPR-Cas9 and related gene editing tools to further develop their patented camelina varieties.²⁵⁵ <u>Es ist nach wie vor unklar, ob und wenn ja in welchen Leindotter-Sorten CRISPR zum Einsatz kommt.</u>	Ja
Erbse, gelb	CRISPR	Altered Antinutrient Composition	Benson Hill (USA)	2x APHIS-Bescheid 2023 (Confirmation letter) ²⁵⁶ Gleicher Trait, unterschiedliche Linien.	Unklar

252 <https://susoiils.com/news/global-clean-energy-announces-advancements-in-herbicide-resistant-camelina-varieties>

253 <https://susoiils.com/news/syngenta-seeds-sustainable-oils-announce-commercial-agreement-to-sell-camelina-seed>

254 <https://www.gceholdings.com/>

255 <https://susoiils.com/news/crispr-cas9-license-agreement>

256 <https://www.aphis.usda.gov/biotechnology/downloads/confirmation-response/23-305-01cr-request.pdf>,
<https://www.aphis.usda.gov/biotechnology/downloads/confirmation-response/23-305-01cr-signed-response.pdf>,
<https://www.aphis.usda.gov/biotechnology/downloads/confirmation-response/23-305-02cr-request.pdf>,
<https://www.aphis.usda.gov/biotechnology/downloads/confirmation-response/23-305-02cr-signed-response.pdf>

Kultur	Verfahren ^{a)}	Eigenschaften	Unternehmen ^{b)}	Entwicklungs-status ^{c)}	Freisetzungs-versuche
Erbse, gelb NEU	Primavera™ gene editing technology	Enhanced climate resilience, taste-neutral proteins ²⁵⁷	GreenVenus (USA), Plant Research LTD. (NZ)	Plant Research (NZ) Ltd brings competitive elite pea lines and breeding expertise to GreenVenus's research. This collaboration is primed to expedite the development of groundbreaking, high-yield varieties, consequently enhancing grower profitability and offering superior protein options for consumers and the animal feed sectors	Unklar

257 https://www.greenvenus.com/wp-content/uploads/2024/03/GreenVenus-and-PRL_feb-23_2024_v4-002.pdf

Kultur	Verfahren ^{a)}	Eigenschaften	Unternehmen ^{b)}	Entwicklungs-status ^{c)}	Freisetzungs-versuche
Kuhbohne PeaMAX NEU	CRISPR	Suitable for mechanized harvesting: Integrates seamlessly with existing soybean harvesting equipment. Shorter growing season: Ideal for summer planting in key soybean growing regions. High protein content: Provides a valuable source of plant-based protein. Drought and heat tolerant: Thrives in challenging climates. ²⁵⁸	BetterSeeds (ISR) ²⁵⁹	APHIS-Bescheid 2024 (Confirmation letter). ²⁶⁰	Gewächshaus

258 https://www.seedquest.com/news.php?type=news&id_article=155769&id_region=&id_category=2450&id_crop

259 <https://www.laweekly.com/seeding-the-future-margalit-and-shermans-betterseeds-journey-from-agronomy-to-crispr-revolution/>

260 <https://www.aphis.usda.gov/sites/default/files/23-261-01rsr.pdf>, <https://www.aphis.usda.gov/sites/default/files/23-261-01rsr-response.pdf>

Kultur	Verfahren ^{a)}	Eigenschaften	Unternehmen ^{b)}	Entwicklungs- status ^{c)}	Freisetzungs- versuche
Acker-Hellerkraut (<i>Thlaspi arvense</i>) Vor- kommerzieller Anbau	CRISPR	Veränderter/erhöhter Ölgehalt im Samen (Kultur wird als Gründüngung über den Winter angebaut, Öl als Speiseöl, Bioenergie, Samen vermahlen als Tierfutter) <u>Weitere APHIS- Bescheide 2024, u. a. this modified version boasts reduced levels of erucic acid, fiber, and glucosinolates in its seeds, along with improved resistance to seed shatter. These alterations aim to enhance the crop's viability as a cover crop and source of biofuel.</u> ²⁶¹	CoverCress Inc. (USA) Bayer gehören 65%, Bunge und Chevron 35% von CoverCress. ²⁶² Organisation der Wertschöpfungs- kette. ²⁶³ Expect to launch crush- ready CoverCress product mid-2020's ²⁶⁴	APHIS-Bescheid 2020 Illinois State University has entered a licensing agreement with CoverCress, Inc. for use of the <i>fae1</i> germplasm. ²⁶⁵ CCI is preparing for a pre- commercial demonstration of the CoverCress crop in select geographies for the 2023/2024 season. ²⁶⁶ Weiterer APHIS-Bescheid für neuen Trait: the pennycress was modified to impart lowered erucic acid in seeds via reduction or loss of fatty acid elongation 1 (FAE1) and to confer lowered fiber in seeds via reduction or loss of transparent testa 8 (TT8). ²⁶⁷	Ja <u>Farm Adoption Program: allows producers to test CoverCress in their operations with no risk. CCI provides the seed free of charge, which can then be treated as a typical cover crop for a few years until a decision is made to move forward with it as a cash crop.</u> ²⁶⁸

261 <https://www.biofuelsdigest.com/bdigest/usda-approves-covercress-pennycress-varietal-among-new-batch-of-aphis-oks/>,
<https://www.aphis.usda.gov/sites/default/files/24-095-01cr-request.pdf>, <https://www.aphis.usda.gov/sites/default/files/24-095-01cr-response.pdf>

262 <https://www.bizjournals.com/stlouis/inno/stories/awards/2023/07/18/startup-exit-awards-2023-covercress-acquisition.html?b=1689715584%5E22271606>

263 <https://www.covercress.com/farm-to-fuel-supply-chain.cfm>

264 https://www.bayer.com/sites/default/files/2023-06/Bayer%20CS%20Innovation%20Summit%202023_Resource%20Guide.pdf (S. 47)

265 <https://www.frontiersin.org/articles/10.3389/fpls.2021.652319/full>, <https://portal.nifa.usda.gov/web/crisprojectpages/1014980-advancing-field-pennycress-as-a-new-oilseed-biofuels-feedstock-that-does-not-require-new-land-commitments.html>, <https://www.biofuelsdigest.com/bdigest/2021/01/17/covercress-inc-and-university-partners-selected-as-start-up-inventor-of-the-year/>

266 <https://www.covercress.com/>

267 <https://www.aphis.usda.gov/brs/pdf/rsr/22-069-01rsr-submission.pdf>, <https://www.aphis.usda.gov/brs/pdf/rsr/22-069-01rsr-review-response.pdf>

Kultur	Verfahren ^{a)}	Eigenschaften	Unternehmen ^{b)}	Entwicklungs-status ^{c)}	Freisetzungs-versuche
Acker-Hellerkraut (Thlaspi arvense)	CRISPR	Altered Seed Composition Altered Pod Composition	CoverCress Inc. (USA)	2023: 3x APHIS-Bescheide (Confirmation letters) für «Altered Seed Composition», 2x APHIS-Bescheide (Confirmation letters) für Altered Pod Composition ²⁶⁹	Unklar
Salat Green Venus™ (Romana Salat) Im Anbau	Botticelli™ plant cell technology, PrimaVera Gene-Editing Tool GreenVenus, LLC's romaine lettuce variety 'GVR-108XL' has edits to five polyphenol oxidase (PPO) genes, which are enzymes responsible for damage-related browning in fruits and vegetables, and negatively affect the shelf life of products such as pre-cut salads. ²⁷⁰	Verlängertes Shelf-life, verringerte enzymatische Bräunungsreaktion (an verletzten Blättern)	Green Venus (USA) Für die Sorte wurde US-Patentschutz angemeldet ²⁷¹ & 2022 erteilt. ²⁷²	APHIS-Bescheid 2019. Green Venus has confirmed they will advance five new lettuce varieties to the field trial phase in 2022 through the application of their precision breeding platform, Primavera™. The complete lineup of varieties will include four romaine types and one Batavia type. In 2020, GreenVenus successfully built open field and controlled environment partnerships to trial and launch their first commercial non browning romaine variety. The variety consistently outperformed the market standards in terms of overall quality and yield and is attracting interest from the \$10.7 billion bagged salad market, which led GreenVenus to prioritize its emerging lettuce business. ²⁷³	USA, ab 2019 <u>Salat ist auch für Hausgärtner erhältlich</u> ²⁷⁴

268 <https://www.farmprogress.com/cover-crops/here-s-your-chance-to-try-covercress>, <https://www.covercress.com/farmers.cfm>

269 Beispieldokument: <https://www.aphis.usda.gov/biotechnology/downloads/confirmation-response/23-142-01cr-request.pdf>, <https://www.aphis.usda.gov/biotechnology/downloads/confirmation-response/23-142-01cr-signed-response.pdf>. Weitere Dokumente: <https://www.aphis.usda.gov/aphis/ourfocus/biotechnology/regulatory-processes/confirmations/responses/cr-table>

Kultur	Verfahren ^{a)}	Eigenschaften	Unternehmen ^{b)}	Entwicklungs-status ^{c)}	Freisetzungs-versuche
Salat NEU	Botticelli™ plant cell technology, PrimaVera Gene-Editing Tool	Fast growing (for controlled-environment settings) ²⁷⁵	Green Venus (USA)	GreenVenus intends to reduce the cost of indoor cultivation and make a sustainable and positive impact on the indoor farming industry	Unklar

270 <https://www.jdsupra.com/legalnews/usda-s-pvp-system-embraces-transgenic-5069271/>

271 <https://apps.ams.usda.gov/CMS/AdobeImages/202000361.pdf>

272 <https://www.troutman.com/insights/troutman-pepper-helps-greenvenus-llc-secure-certificate-protection-for-a-gene-edited-lettuce-variety-under-plant-variety-protection-act.html>, <https://apps.ams.usda.gov/CMS/AdobeImages/202000361.pdf>

273 <https://www.greenvenus.com/wp-content/uploads/2022/01/GreenVenus-Expands-Non-Browning-Lettuce-Portfolio.pdf>

274 <https://greenvenusproduce.com/collections/all>

275 <https://www.greenvenus.com/wp-content/uploads/2024/09/GreenVenus-Introduces-Fast-Growing-Lettuce-Varieties-for-Indoor-Farming.pdf>, <https://igrownews.com/greenvenus-latest-news/>

Kultur	Verfahren ^{a)}	Eigenschaften	Unternehmen ^{b)}	Entwicklungs- status ^{c)}	Freisetzungs- versuche
Senf (Mustard Green) Conscious™ Greens²⁷⁶ Im Anbau	CRISPR Mai 2023: launch of Fulcrum™ Platform²⁷⁷ Wissenschaftliche Publikation zum Verfahren²⁷⁸ Kommentar zur Regulierungsdebatte in Nature²⁷⁹	Verbesserter Geschmack Neuer Trait? Veränderte Schärfe und Textur	Pairwise Plants (USA), Bayer Crop Science (DEU), Vertrieb u. a. durch Performance Foodservice²⁸⁰ und RSquared Fresh Solutions²⁸¹ Conscious™ Greens will be grown in the Salinas Valley, California, a place often referred to as “America’s salad bowl.” In the winter months, our Greens will be grown in Yuma, Arizona.²⁸² <u>The agreement allows Bayer to further develop and commercialize 10 varieties of Pairwise-edited greens, and to develop and breed for new varieties with the technology.</u>²⁸³	APHIS-Bescheid 2020. Weiterer APHIS-Bescheid 2023²⁸⁴ für neuen Trait? (Antrag auf Überprüfung des Regulierungsstatus) April 2023: Health Canada has added Pairwise’s gene edited mustard greens to its list of “non-novel” foods.²⁸⁵ Salad is now available in select restaurants and outlets in the Performance Food Group’s (PFG) operator network, including locations in Springfield, Mass., Minneapolis-St. Paul, and St. Louis.²⁸⁶ <u>Februar 2024: Pairwise zieht sich aus Vermarktung zurück.</u>²⁸⁷ <u>Bayer CropScience übernimmt die Vermarktung.</u>²⁸⁸ <u>Bayer plans to distribute the salad to grocery stores across the country.</u>²⁸⁹	Ja

276 <https://consciousfoods.net/conscious-greens>

277 <https://www.pairwise.com/news/pairwises-fulcrum-platform-creates-pivot-point-for-enterprise-scale-gene-editing>

278 <https://www.mdpi.com/2223-7747/11/19/2494/htm>

279 <https://www.nature.com/articles/s41477-023-01403-2>

280 <https://performancefoodservice.com/Products-and-Services/Our-Family-of-Brands/Peak-Fresh-Produce/Veridi-Baby-Blend-by-Conscious-Greens>

Kultur	Verfahren ^{a)}	Eigenschaften	Unternehmen ^{b)}	Entwicklungs- status ^{c)}	Freisetzungs- versuche
Alfalfa/ Luzerne IQ™ Alfalfa	TALEN	Verbesserte Nährstoff- zusammensetzung, bessere Verdaulichkeit, hohe Erträge Trait wurde von Calyxt entwickelt (Calyxt ist jetzt Teil von Cibus Inc.).	S&W Seed Company (USA) S&W hat Exklusivlizenz für Saatgutvertrieb in den USA und mehreren Regionen ausserhalb der Vereinigten Staaten mit Ausnahme der Europäischen Union, des Vereinigten Königreichs, der Ukraine, Russlands und Indiens. ²⁹⁰ <u>Vertrieb über Alfalfa</u> <u>Partners</u> ²⁹¹	APHIS-Bescheid 2017 S&W: we made progress with our IQ™ Alfalfa. Our future alfalfa varieties will soon include IQA™, a reduced lignin alfalfa quality trait, achieved through gene editing. It's integrated into elite alfalfa germplasm for both yield and improved forage quality performance. (...) Please consult with Alfalfa Partners for availability in your region and whether your specific growing environment may be sensitive to a gene-edited trait. ²⁹²	Ja

281 <https://www.pairwise.com/news/conscious-foods-a-pairwise-brand-partners-with-food-broker-rsquared-fresh-solutions-in-retail-channel>

282 <https://consciousfoods.net/process>

283 <https://www.pairwise.com/news/pairwise-and-bayer-expand-crispr-leafy-greens-market-through-licensing-agreement>

284 <https://www.aphis.usda.gov/brs/pdf/rsr/22-159-01rsr-submission.pdf>, <https://www.aphis.usda.gov/brs/pdf/rsr/22-159-01rsr-review-response.pdf>

285 <https://www.pairwise.com/news/health-canada-gives-pairwises-conscious-greens-a-nod-of-approval>

286 <https://www.pairwise.com/news/pairwise-introduces-conscious-greens-into-u.s.-restaurants>

287 <https://www.foodnavigator-usa.com/Article/2024/02/13/Exclusive-Pairwise-stops-marketing-gene-edited-Conscious-Greens-to-focus-on-new-high-value-gene-edited-crops>

288 <https://www.bayer.com/media/bayer-nutzt-genomeditierung-fuer-naehrstoffreicheres-gemuese/>

289 <https://www.wired.com/story/gene-edited-salad-greens-fall-pairwise-bayer-crispr-gmo/>

290 <https://ir.calyxt.com/sec-filings/annual-reports/content/0001564590-21-010976/0001564590-21-010976.pdf>, <https://www.marketwatch.com/press-release/sw-announces-first-quarter-fiscal-2022-financial-results-2021-11-11?siteid=bigcharts&dist=bigcharts&tesla=y>

291 <https://alfalfapartners.com/iqa/>

292 <https://swseedco.com/research-development/iqa-the-next-innovation/>

Kultur	Verfahren ^{a)}	Eigenschaften	Unternehmen ^{b)}	Entwicklungs- status ^{c)}	Freisetzungs- versuche
Weizen Im Anbau?	CRISPR <u>Qi Biodesign is engaged in genomic innovation with its proprietary SEEDIT research platform. The platform features advanced genome editing tools, including novel RNA-guided nucleases, base editors, plant prime editors and PrimeRoot editors for exact large DNA insertions and manipulations.</u>	Mehltauresistenz	Suzhou Qihe Biotechnology Co., Ltd. (Qi Biodesign), ²⁹³ Chinese Academy of Sciences (CHN)	Scientists at the Chinese Academy of Sciences have used multiplexed CRISPR genome editing to achieve robust disease resistance in <u>wheat</u> without any growth defects. The results of this study are published in <i>Nature</i> . ²⁹⁴ Approval is expected soon on a wheat variety resistant to a fungal disease called powdery mildew. ²⁹⁵ <u>Mai 2024: Sicherheitszertifikat des Chin. Landwirtschaftsministeriums</u> ²⁹⁶	Ja

293 <https://www.mobihealthnews.com/news/qi-biodesign-secures-75m-genome-editing-technology>, https://cd-healthinv.com/en/news_id1398.html

294 https://english.cas.cn/head/202202/t20220210_300634.shtml

295 <https://crispr-gene-editing-regs-tracker.geneticliteracyproject.org/china-crops-food/>

296 <https://www.keine-gentechnik.de/nachricht/34941?cHash=93b50609233157b0f9acfa90411bfeda>, <https://www.reuters.com/markets/commodities/china-approves-first-gene-edited-wheat-step-open-up-gm-tech-food-crops-2024-05-08/>, <https://www.isaaa.org/kc/cropbiotechupdate/ged/article/default.asp?ID=20821>

Kultur	Verfahren ^{a)}	Eigenschaften	Unternehmen ^{b)}	Entwicklungs- status ^{c)}	Freisetzungs- versuche
Weizen NEU	CRISPR	Mutated TaALS gene herbicide-tolerant wheat TaALS-4	Suzhou Qi-Biodesign Biotechnology Company Limited (CHN), Institute of Genetics and Developmental Biology, Chinese Academy of Sciences (CHN)	Biosafety Certificate Validity (CHN): Dec. 2024 – Dec. 2029 ²⁹⁷	Unklar

²⁹⁷ <https://apps.fas.usda.gov/newgainapi/api/Report/DownloadReportByFileName?fileName=New%20and%20Renewed%20Biosafety%20Certificates%20Issued%20-%20December%202024%20Beijing%20China%20-%20People%27s%20Republic%20of%20CH2024-0180.pdf>

Kultur	Verfahren ^{a)}	Eigenschaften	Unternehmen ^{b)}	Entwicklungs-status ^{c)}	Freisetzungs-versuche
Weizen	CRISPR (Cas-Enzym undeklariert, patentiert von Inari) SEEDesign™ a) Predictive Design: creating an editing blueprint through deep learning and machine learning b) Multiplex editing toolkit: facilitating multiple edits across multiple genes²⁹⁸	Yield increase <u>InterGrain hat Anfang 2024 Weizensaatgut verschiedener Zuchtlinien importiert, die vom amerikanischen Biotechunternehmen Inari mittels CRISPR/Cas verändert wurden und Hunderte neuer genetischer Varianten enthalten. Diese Linien wachsen nun in einem Versuchsgewächshaus im Südosten Queenslands heran. Aus dem Anbau dieser Pflanzen wird Saatgut gewonnen, damit in der Anbausaison 2025 genügend Saatgut für mehr als 45 Versuchsstandorte im ganzen Land zur Verfügung steht.</u>²⁹⁹	Inari Agriculture Inc. (USA), InterGrain (AUS)	Together, InterGrain and Inari are targeting a 10-15 percent increase in wheat yield potential, in addition to more efficient use of inputs.³⁰⁰	<u>Ja, ab 2025</u>

298 <https://inari.com/seeddesign>

299 <https://groundcover.grdc.com.au/innovation/plant-breeding/wheat-varieties-of-the-future-edging-closer>, <https://www.reuters.com/markets/commodities/australian-trial-gene-edited-wheat-aims-10-bigger-yields-2024-05-23/>

300 <https://inari.com/intergrain-and-inari-launch-collaboration-to-deliver-step-change-in-wheat-yield-potential/>

Kultur	Verfahren ^{a)}	Eigenschaften	Unternehmen ^{b)}	Entwicklungs-status ^{c)}	Freisetzungs-versuche
Sorghum	CRISPR	Herbizidresistenz <u>In partnership with Tobin, a leading sorghum seed breeding and production company, a leader in sorghum breeding and seed production, we are editing elite lines to bring new hybrids to international markets more rapidly and efficiently.</u>³⁰¹	Bioheuris (ARG, USA), Tobin (ARG)	Es sind 5 verschiedene HR-Traits in Arbeit. 2022: APHIS-Bescheid (Confirmation letter)³⁰² 2023: APHIS-Bescheid (Confirmation letter)³⁰³ 2023: Zulassung in Brasilien³⁰⁴	Unklar

301 <https://www.bioheuris.com/en/what-we-do/>

302 <https://www.aphis.usda.gov/biotechnology/downloads/confirmation-response/22-201-01cr-request.pdf>

303 <https://www.aphis.usda.gov/biotechnology/downloads/confirmation-response/22-329-01cr-request.pdf>,
<https://www.aphis.usda.gov/biotechnology/downloads/confirmation-response/22-329-01cr-response-signed.pdf>

304 [https://one.oecd.org/document/ENV/CBC/MONO\(2024\)22/en/pdf](https://one.oecd.org/document/ENV/CBC/MONO(2024)22/en/pdf)

Kultur	Verfahren ^{a)}	Eigenschaften	Unternehmen ^{b)}	Entwicklungs- status ^{c)}	Freisetzungs- versuche
Zuckerrübe	GEiGS® (Gene Editing induced Gene Silencing)	The program is set to develop high-performance sugar beet varieties that can sustainably withstand viral diseases, doing away with the need for environmentally damaging pesticides <u>Resistance to Virus Yellows</u>	Tropic Bioscience (GBR), British Sugar (GBR)	British Sugar and Tropic announce strategic collaboration to sustainably tackle devastating disease of sugar beet <u>British Sugar secured just over £660,000 in grant funding from the Government</u>³⁰⁵	Nein

305 <https://www.britishsugar.co.uk/media/news/2024-02-14-british-sugar-secures-gbp-660k-government-funding-for-gene-editing-research>

Kultur	Verfahren ^{a)}	Eigenschaften	Unternehmen ^{b)}	Entwicklungs-status ^{c)}	Freisetzungs- versuche
Zuckerrohr Canaflex I	CRISPR	Bessere Verdaulichkeit	Agricultural Research Corporation (EMBRAPA, Agroenergia) (BRA)	Canaflex I ist das Ergebnis der Ausschaltung des Gens, das für die Steifigkeit der pflanzlichen Zellwand verantwortlich ist. Diese Struktur wurde verändert und wies eine bessere "Verdaulichkeit" auf, d. h. eine bessere Zugänglichkeit für den Angriff der Enzyme während der enzymatischen Hydrolyse, dem chemischen Prozess, der die Verbindungen aus der Pflanzenbiomasse extrahiert. 2021: Zulassung als non-GMO gemäss der Nationalen Technischen Kommission für Biosicherheit (CTNBio).³⁰⁶	Ja

306 <https://www.embrapa.br/busca-de-noticias/-/noticia/66969890/ciencia-brasileira-desenvolve-primeira-cana-editada-nao-transgenica-do-mundo>

Kultur	Verfahren ^{a)}	Eigenschaften	Unternehmen ^{b)}	Entwicklungs- status ^{c)}	Freisetzungs- versuche
Zuckerrohr Canaflex II	CRISPR	Erhöhter Saccharosegehalt	Agricultural Research Corporation (EMBRAPA, Agroenergia) (BRA)	Die zweite Sorte wurde durch das Ausschalten eines Gens im Pflanzengewebe erzeugt, was zu einer erheblichen Steigerung der Saccharoseproduktion in den Stängeln der Modellpflanze <i>Setaria viridis</i> führte. Cana Flex II zeigte einen Anstieg der Saccharose in den Stängeln um bis zu 15 Prozent, 200 Prozent mehr Saccharose in den Blättern und 12 Prozent mehr Glukose, die während der Verzuckerung freigesetzt wird. 2021: Zulassung als non-GMO gemäss der Nationalen Technischen Kommission für Biosicherheit (CTNBio).³⁰⁷	Ja

307 <https://www.embrapa.br/busca-de-noticias/-/noticia/66969890/ciencia-brasileira-desenvolve-primeira-cana-editada-nao-transgenica-do-mundo>

Kultur	Verfahren ^{a)}	Eigenschaften	Unternehmen ^{b)}	Entwicklungs- status ^{c)}	Freisetzungs- versuche
Mandel NEU	CRISPR	Improved agronomic property 1) Reduction or loss of function of the enzyme that functions as the pistil-associated self-incompatibility factor2 and 2) Reduction or loss of function of the pollen-associated self-incompatibility factor2	Ohalo Genetics Inc. (USA)	APHIS-Bescheid 2024 ³⁰⁸ After four years of dedicated research and development, Ohalo is proud to announce completion of its USDA Regulatory Status Review process for FruitionOne with availability for early orders in late 2026 and first commercial deliveries beginning in 2027. The first FruitionOne trial orchard plantings are underway in California. ³⁰⁹	Unklar

308 <https://www.aphis.usda.gov/sites/default/files/23-254-01rsr-response.pdf>

309 https://www.prnewswire.com/news-releases/ohalo-announces-fruitionone-the-worlds-first-self-fertile-nonpareil-almond-variety-302289195.html?tc=eml_cleartime

Kultur	Verfahren ^{a)}	Eigenschaften	Unternehmen ^{b)}	Entwicklungs-status ^{c)}	Freisetzungs-versuche
Rizinus	Erste Sorten wurden konventionell entwickelt, künftige Pflanzen ev. mit CRISPR Casterra's castor seeds were developed using Evogene's computational GeneRator AI and ChemPass AI platforms, proprietary germplasm data and "unparalleled genetics knowledge".³¹⁰	4 to 6 times higher yield than wild type castor plants and generate 50% castor oil yields compared to natural varieties generating 30% to 40%, and do so under difficult growing conditions	Casterra (ISR), Tochterunternehmen von Evogene (ISR) Evogene's wholly-owned subsidiary Casterra Ag has received initial purchase orders worth \$11.3 million for its proprietary castor plant seeds, which will be used for biofuel production in Africa. Castor oil is increasingly seen as a green biofuel in Europe, with EU regulations requiring 14% of transportation fuels to be biofuels by 2030.	In discussing Casterra's potential other development plans, Mr. Ronen discussed Casterra's ability to use Evogene's leading-edge <i>CRISPR</i> and/or <i>RNAi technology</i>, to genomically modify castor plants in order to produce specific characteristics, such as castor oil with more suitable characteristics for the aviation market versus the automobile industry, and even potentially developing a castor plant, which may be suitable for animal feed. Ronen explained that Casterra might be able to produce a castor plant without ricin, which is toxic, which would then allow the use of the protein part of the castor plant, which is the cake left after crushing, for use as animal feed.³¹¹	Ja

³¹⁰ https://evogene.com/wp-content/uploads/2023/05/Casterra_company_presentation_May_2023_FINAL.pdf

³¹¹ <https://seekingalpha.com/article/4615412-evogene-subsiidary-casterra-11-3m-sale-of-castor-plant-seeds-may-be-tip-of-iceberg>

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

(UPDATE Stand: Januar 2025, Neue Einträge sind unterstrichen)

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

Kultur	Verfahren ^{a)}	Eigenschaften	Unternehmen ^{b)}	Entwicklungs- status ^{c), d)}	Freisetzungs- versuche
Soja NEU	CRISPR	Resistance against Asian Soybean Rust ³¹²	Bayer Crop Science (DEU), Pairwise (USA)	Forschung & Entwicklung	Unklar
Soja	CRISPR	Yield gene C3004, C3003	Yield10 Bioscience (USA), Bayer Crop Science (DEU) The research license with Bayer is scheduled to expire in December ³¹³	Forschung & Entwicklung „Under the amended research license, Bayer will have access to these new developments from Yield10's C3004 program and new advanced technology related to the C3004 trait and its potential to increase seed yield.“ ³¹⁴	Unklar

312 <https://agfundernews.com/crispr-and-the-new-era-of-precision-plant-breeding-in-conversation-with-pairwise-ceo-dr-tom-adams>

313 <https://www.zonebourse.com/cours/action/YIELD10-BIOSCIENCE-INC-39016366/actualite/Transcript-Yield10-Bioscience-Inc-Q3-2022-Earnings-Call-Nov-14-2022-42313329/>

314 <https://ir.yield10bio.com/static-files/cb2ac804-60e9-440c-8b91-b449941643a3>

Kultur	Verfahren ^{a)}	Eigenschaften	Unternehmen ^{b)}	Entwicklungs- status ^{c), d)}	Freisetzungs- versuche
Soja	CRISPR	Multiple Traits, “GDM plans to work with Yield10 yield traits within its research and development program for soybean as a strategy to improve soybean yield performance and sustainability”.	Yield10 Bioscience (USA), GDM (ARG)	Forschung & Entwicklung, 3-jährige Forschungs- zusammenarbeit (2020 - 2023) ³¹⁵	Unklar
Soja, Mais	CRISPR GEiGS® Technology (Gene-Editing, RNAi)	Krankheitsresistenzen	Corteva , (USA), Tropic Bioscience (GBR)	Tropic Announces collaboration with Corteva Agriscience to develop disease resistance traits in Corn and Soybean. ³¹⁶	Nein
Soja NEU	CRISPR	Growth promotion	Tevah Consutoria Regulatória (BRA)	2023: Zulassung Brasilien ³¹⁷	Unklar
Reis NEU	CRISPR	Verringerter Glutelin-Gehalt The rice is meant to be used as unctional food and supposed to have a positive effects on the health of consumers who suffer from conditions, such as diabetes or renal insufficiency.	Institute of Agrobiological Sciences, National Agriculture and Food Research Organization (NARO) (JPN)	Die Forscher haben angekündigt, dass sie den Reis in Japan zum kommerziellen Anbau bringen wollen. ³¹⁸	Nein

315 <https://ir.yield10bio.com/static-files/cb2ac804-60e9-440c-8b91-b449941643a3>, <https://www.globenewswire.com/en/news-release/2020/08/11/2076385/34378/en/Yield10-Bioscience-Signs-Research-Agreement-with-GDM-to-Evaluate-New-Yield-Traits-in-Soybean.html>

316 <https://tropic.bio/tropic-announces-collaboration-with-corteva-agriscience-utilizing-tropics-groundbreaking-geigs-technology-to-develop-robust-disease-resistance-traits-in-corn-and-soybean/>

317 [https://one.oecd.org/document/ENV/CBC/MONO\(2024\)22/en/pdf](https://one.oecd.org/document/ENV/CBC/MONO(2024)22/en/pdf)

Kultur	Verfahren ^{a)}	Eigenschaften	Unternehmen ^{b)}	Entwicklungs- status ^{c), d)}	Freisetzungs- versuche
Reis NEU	CRISPR	Resistenz gegen Reisbrand ³¹⁹	Agricultural Research Council, Centro di sperimentazione e certificazione delle sementi, Università degli Studi di Milano (ITA)	Forschung & Entwicklung	2024: Freisetzungsversuch ³²⁰ in Italien (wurde zerstört) ³²¹
Reis	GEiGS® Technology (Gene-Editing, RNAi)	Resistance to rice blast	Tropic Bioscience (GBR)	We create natural resistance to rice blast, a disease which is estimated to destroy enough rice to feed more than 60 million people annually. Preserving rice fields creates more food and supports a more stable and sustainable income for farmers in vulnerable communities. ³²²	Gewächshausversuche

318 <https://link.springer.com/article/10.1007/s00299-023-03131-5>, <https://www.testbiotech.org/aktuelles/waechst-schon-bald-reis-aus-neuer-gentechnik-auf-den-feldern/>, https://www.testbiotech.org/wp-content/uploads/2024/03/Testbiotech_Backgounder_NGT_rice-low-glutelin.pdf

319 <https://link.springer.com/content/pdf/10.1007/s10658-014-0588-1.pdf>

320 <https://ec.europa.eu/food/food-feed-portal/screen/gmob/search/details/POL-GMOB-IMPORT-10719>

321 <https://bch.mase.gov.it/index.php/it/?view=article&id=435&catid=15>, <https://disaapress.unimi.it/distrutto-il-campo-sperimentale-di-riso-ris8imo-sviluppato-con-le-tea/>, <https://www.swissinfo.ch/eng/vandals-destroy-italy%27s-first-experimental-rice-field/81675807>

322 <https://tropic.bio/rice/>, <https://tropic.bio/sustainable-rice-how-tropic-uses-gene-editing-to-protect-this-staple-crop-from-climate-change/>

Kultur	Verfahren ^{a)}	Eigenschaften	Unternehmen ^{b)}	Entwicklungs-status ^{c), d)}	Freisetzungs-versuche
Reis	GEiGS® Technology (Gene-Editing, RNAi)	Erhöhter Ertrag	Tropic Bioscience (GBR)	Our rice plants have the potential to significantly reduce greenhouse gas emissions per calorie, through increased yields. Here's to the rice revolution. ³²³	Gewächshaus-versuche
Reis	CRISPR	New rice varieties which deliver higher yields and are more resilient against biotic and abiotic stresses	Corteva (USA), International Rice Institute (IRRI) (PHL) ³²⁴	Forschung & Entwicklung	Unklar
Reis	CRISPR	Altered Reproductive Function	Syngenta (CHN, CH)	2022: APHIS-Bescheid (Confirmation letter) ³²⁵	Unklar
Weizen	Rapid Trait Development System (RTDS™), ODM	We expect to develop a family of traits for corn focusing initially on nutrient use efficiency, disease and herbicide tolerance	Cibus Inc. (USA)	We expect to have our RTDS breeding platform in Wheat developed by the end of 2024. ³²⁶	Nein
Weizen	CRISPR	Reduzierter Acrylamid-Gehalt Preliminary results from ...	Rothamsted Research (GBR) has been granted	The Hertfordshire-based experiments will be the first field trials of CRISPR	September 2021 bis Dezember 2026

³²³ <https://tropic.bio/rice/>, <https://tropic.bio/sustainable-rice-how-tropic-uses-gene-editing-to-protect-this-staple-crop-from-climate-change/>

³²⁴ <https://publications.jrc.ec.europa.eu/repository/handle/JRC123830>, S. 21

³²⁵ <https://www.aphis.usda.gov/biotechnology/downloads/confirmation-response/22-250-01cr-request.pdf>

³²⁶ <https://www.cibus.com/productivity-traits.php>

Kultur	Verfahren ^{a)}	Eigenschaften	Unternehmen ^{b)}	Entwicklungs- status ^{c), d)}	Freisetzungs- versuche
		field trials of gene-edited (GE) wheat have indicated there's no yield or other agronomic penalty from the precision breeding technique.³²⁷ <u>Der Weizen wird 2025 – 2026 im Rahmen des Projekts PROBITY (Platform to Rate Organisms Bred for Improved Traits and Yield) auf verschiedenen konventionellen landwirtschaftlichen Betrieben in GBR getestet.</u>³²⁸	permission by Defra to run a series of field trials of wheat that has been genome edited.	edited wheat anywhere in the UK or Europe.³²⁹ 2023: The results of ... field trial of a gene edited (GE) variety of wheat have shown a significant reduction of the potential carcinogen acrylamide when the flour is baked.³³⁰ Wissenschaftliche Publikation erschienen³³¹	
Weizen	CRISPR	Erhöhter Proteingehalt, für Aquakulturen	Amfora (USA)	Forschung & Entwicklung ³³²	Unklar
Weizen	CRISPR Genome Editing auf Ebene	Hybridweizen	Napigen (USA)	Forschung & Entwicklung ³³³	Unklar

327 <https://www.fwi.co.uk/arable/variety-selection/europes-first-gene-edited-wheat-trials-see-breakthrough>

328 <https://www.rothamsted.ac.uk/news/scientists-looking-forward-first-farmer-led-trials-gene-edited-crops-europe>

329 <https://www.rothamsted.ac.uk/news/genome-edited-wheat-field-trial-gets-go-ahead-uk-government>, <https://www.rothamsted.ac.uk/news/genome-edited-wheat-reduce-cancer-risk-bread-and-toast>, https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1010792/rothamsted-research-21-R08-01-consent.pdf, <https://www.rothamsted.ac.uk/news/results-are-gene-edited-wheat-field-trial-delivers>

330 <https://www.rothamsted.ac.uk/news/results-are-gene-edited-wheat-field-trial-delivers>, <https://www.isaaa.org/kc/cropbiotechupdate/ged/article/default.asp?ID=20047>

331 <https://onlinelibrary.wiley.com/doi/10.1111/pbi.14026>

332 <https://www.amforainc.com/copy-of-technology>

Kultur	Verfahren ^{a)}	Eigenschaften	Unternehmen ^{b)}	Entwicklungs- status ^{c), d)}	Freisetzungs- versuche
	von Mitochondrien und Organellen	“Our company’s hybridization technology allows the production of non-GM hybrid seeds in crop plants that are currently mostly non-hybrid such as wheat.”		March 5, 2024: The U.S. Patent and Trademark Office has issued a patent to NAPIGEN, Inc. for the use of CRISPR technologies to edit organellar genomes. June 6, 2024: The Commissioner of Patents for the Australian Patent Office has granted a patent, AU 2018320864 B2, to NAPIGEN, Inc. for the use of CRISPR technologies to edit organellar genomes.³³⁴	
Weizen	CRISPR	Krankheitsresistenz, Ertrag/Ertragsstabilität	Corteva (USA)	„Broad R & D Investigations“ ³³⁵	Unklar
Weizen	CRISPR	Hybridweizen Mehrere aktuelle wissenschaftliche Publikationen bestätigen, dass CRISPR im Bereich der Hybridzüchtung eingesetzt wird.	Corteva (USA)	Zeitpunkt der Kommerzialisierung unklar. Keine aktuellen Informationen verfügbar ³³⁶	USA, ab 2016

333 <https://napigen.com/what-we-do>

334 <https://napigen.com/whats-new-1>

335 <https://www.dtnpf.com/agriculture/web/ag/crops/article/2021/02/22/designer-crops>

336 <https://www.dtnpf.com/agriculture/web/ag/crops/article/2021/02/22/designer-crops>

Kultur	Verfahren ^{a)}	Eigenschaften	Unternehmen ^{b)}	Entwicklungs-status ^{c), d)}	Freisetzungs-versuche
Weizen	CRISPR RNAi	Gluten“freier“ Weizen Currently, there are two main research centres in the EU developing low-gluten, celiac-safe wheat varieties with gene editing (SDN-1 type CRISPR/Cas targeted mutation) Alle Details zum Projekt im ausführlichen JRC-Report ³³⁷	Institute for Sustainable Agriculture in Cordoba (ESP), PBL Technologies (GBR) ³³⁸ <u>Now, a second gene-edited wheat line has been successfully generated, targeting the gamma and omega gliadins followed by crosses with alpha gliadin mutants, achieving a 97.7% reduction in gluten content.</u> ³³⁹	Neue wiss. Publikation ³⁴⁰ The CSIC gliadin-reduction technology is the subject of pending patent applications filed by CSIC and is available for licensing from PBL. ³⁴¹	Ja 2023–2025
Weizen	CRISPR	Gluten“freier“ Weizen Alle Details zum Projekt im ausführlichen JRC-Report ³⁴²	Plant Breeding group at Wageningen University & Research (WUR), John Bingham	The WUR group designed a gene-edited wheat targeting alpha and gamma gliadins to achieve a variety	Nein

337 https://publications.jrc.ec.europa.eu/repository/bitstream/JRC131711/JRC131711_01.pdf

338 <https://www.pbltechnology.com/about-us>

339 <https://s3.eu-west-2.amazonaws.com/netmatters-cockpit-assets-production/plant-bioscience/2024/09/30/66fa8c1608d5616.604-Gene-Editing-to-Reduce-Gliadins-in-Wheat.pdf>

340 <https://www.frontiersin.org/articles/10.3389/fpls.2021.663653/full>

341 <https://s3.eu-west-2.amazonaws.com/netmatters-cockpit-assets-production/plant-bioscience/2022/11/25/6380dee47495810.512-Reduced-Gliadin-Wheat-Tech-Sheet-24.11.22.pdf>

342 https://publications.jrc.ec.europa.eu/repository/bitstream/JRC131711/JRC131711_01.pdf

Kultur	Verfahren ^{a)}	Eigenschaften	Unternehmen ^{b)}	Entwicklungs- status ^{c), d)}	Freisetzungs- versuche
			Laboratory (GBR)	safe for CD. These lines are at proof-of-concept stage and still contain too many epitopes that need to be knocked out to be safe for celiac patients	
Weizen	CRISPR Projekt PILTON (seit 2020)	Pilztoleranz Weizenpflanzen mit verbesserter, multipler und dauerhafter Pilztoleranz	Träger: Gemeinschaft zur Förderung von Pflanzen-innovation e. V. (GFPI) <u>Topagrar 2024:</u> <u>«Letzte Projektschritte stehen noch aus, um finale Aussagen, z. B. zur Güte des Merkmals „Pilztoleranz“, machen zu können. Grundsätzlich bewerten wir den Verlauf des Projektes aber positiv.»³⁴³</u>	Forschung & Entwicklung, Gewächshausversuche laufen ³⁴⁴ Beteiligt: knapp 60 Züchtungsunternehmen: neben Bayer, Syngenta, KWS, Weizen-, Raps-, Kartoffel- und Rebenzüchter sowie Biotechnologie-Startups und Südzucker.	Geplant In zwei Berichten gibt es Updates zum Stand der Forschung ³⁴⁵

343 https://www.bdp-online.de/de/Presse/Aktuelle_Meldungen/Gesunde_Sorten_senken_Resistenzgefahr/2024-1_TOP_SPEZIAL_Interview_BDP.pdf

344 <https://pilton.bdp-online.de/2021/08/12/update-3/>

345 <https://european-seed.com/2022/11/pilton-for-fast-track-breeding-the-way-must-be-paved/>, <https://european-seed.com/2022/11/aims-of-the-joint-research-project-pilton/>

Kultur	Verfahren ^{a)}	Eigenschaften	Unternehmen ^{b)}	Entwicklungs- status ^{c), d)}	Freisetzungs- versuche
Mais NEU	CRISPR	CRISPR-Cas9 technology was used to create the 3 maize concepts: waxy maize, NLB18 maize with improved resistance to NCLB, DL maize with improved resistance to NCLB and SCR	Corteva Agriscience Belgium B.V. (BEL)	Purpose of the release: Not provided	Freisetzungs- versuch (Belgien): 15/04/2025 bis 30/11/2026
Mais NEU	CRISPR	CRISPR-Cas9 waxy maize was generated to delete the endogenous Wx1 gene. This is the first request for a field release of CRISPR-Cas9 waxy maize in the European Union. CRISPR-Cas9 waxy maize non-regulated/non-GMO status has been confirmed in several jurisdictions.	Pioneer Hi-Bred Agro Servicios Spain (member of Corteva Agriscience group of companies) (ESP, USA)	The main purpose of the field trial is for educational purposes and to show the potential of gene editing technology.	Freisetzungs- versuch (Spanien): 01/04/2025 bis 31/12/2025 ³⁴⁶

346 <https://ec.europa.eu/food/food-feed-portal/screen/gmob/search/details/POL-GMOB-IMPORT-10565>

Kultur	Verfahren ^{a)}	Eigenschaften	Unternehmen ^{b)}	Entwicklungs-status ^{c), d)}	Freisetzungs-versuche
Mais NEU	CRISPR	CRISPR-Cas9 NLB18 maize with improved resistance to northern corn leaf blight (NCLB) fungal disease which was achieved by targeted replacement of the disease-susceptible allele of the NLB18 gene (NLB18-S) with the disease resistant allele of the same gene (NLB18-R). This is the first request for a field release of CRISPR-Cas9 NLB18 maize in the European Union. It has received non-regulated/non-GMO confirmations in a number of jurisdictions.	Pioneer Hi-Bred Agro Servicios Spain (member of Corteva Agriscience group of companies) (ESP, USA)	The main purpose of the field trial is for educational purposes and to show the potential of gene editing technology.	Freisetzungs-versuch (Spanien): 01/04/2025 bis 31/12/202 ³⁴⁷
Mais NEU	CRISPR	CRISPR-Cas9 DL Maize was developed using CRISPR-Cas9 technology to incorporate a single sequence locus of cisgenes (NLB18, Ht1 and RppK) for improved resistance to two maize fungal diseases, northern corn leaf blight (NCLB) and southern corn rust (SCR).	Pioneer Hi-Bred Agro Servicios Spain (member of Corteva Agriscience group of companies) (ESP, USA)	The main purpose of the field trial is for educational purposes and to show the potential of gene editing technology.	Freisetzungs-versuch (Spanien): 01/04/2025 bis 31/12/202 ³⁴⁸

347 <https://ec.europa.eu/food/food-feed-portal/screen/gmob/search/details/POL-GMOB-IMPORT-10566>

348 <https://ec.europa.eu/food/food-feed-portal/screen/gmob/search/details/POL-GMOB-IMPORT-10567>

Kultur	Verfahren ^{a)}	Eigenschaften	Unternehmen ^{b)}	Entwicklungs-status ^{c), d)}	Freisetzungs-versuche
Mais	Rapid Trait Development System (RTDS™), ODM	We expect to develop a family of traits for corn focusing initially on nutrient use efficiency, disease and herbicide tolerance.	Cibus Inc. (USA)	We expect to have our RTDS breeding and Trait Machine platform in Corn developed by the end of 2025.	Nein
Mais	CRISPR	Herbizidresistenz	Bioheuris (ARG, USA)	In our maize program we are creating novel traits to manage weeds.	Nein
Mais	CRISPR	Resistenz gegen Blattfleckenkrankheit (Northern Corn Leaf Blight) Wissenschaftlicher Artikel zu Krankheitsresistenz in Mais erschienen. ³⁴⁹	Corteva (USA)	APHIS-Bescheid 2018 ³⁵⁰ Using corn as a pilot, we have identified a pipeline of native genes to target major disease problems. We have successfully enhanced these genes to improve the level of disease resistance. ³⁵¹	Ja, sollen 2023 ausgeweitet werden <u>Ab 2025 Freisetzungsversuche in Belgien und Spanien geplant</u> ³⁵²
Mais	CRISPR (CRISPR-Cpf1/Cms1)	Photosynthetic efficiency trait, Ertragssteigerung	Benson Hill (USA), Beck's (USA)	Forschung & Entwicklung, anticipate filing a	Nein (Elitelinien: ja)

349 <https://bsppjournals.onlinelibrary.wiley.com/doi/10.1111/mpp.13319>

350 <https://www.dtnpf.com/agriculture/web/ag/crops/article/2021/02/22/designer-crops>

351 <https://www.corteva.com/resources/media-center/corteva-announces-plant-breeding-innovation-to-combat-corn-disease.html>

352 https://www.health.belgium.be/sites/default/files/uploads/fields/fpshealth_theme_file/b-be-24v-7_snif.pdf

Kultur	Verfahren ^{a)}	Eigenschaften	Unternehmen ^{b)}	Entwicklungs- status ^{c), d)}	Freisetzungs- versuche
	CropOS™ platform: combines machine learning & big data with genome editing and plant biology			regulatory dossier with the USDA by 2021. ³⁵³	
Mais	CRISPR SDN-1	Scientific field evaluation of maize with an impaired DNA- repair mechanism	Vlaams Instituut voor Biotechnologie (VIB) (BEL)	Freisetzungs- versuche seit 2017, erst seit 2018 im EU-GMO Register	2017-2019 Noch kein Final Report verfügbar. ³⁵⁴
Mais	CRISPR SDN-1	Scientific field evaluation of maize with improved digestibility	Vlaams Instituut voor Biotechnologie (VIB) (BEL)	The genetically modified maize plants have an altered composition of their cell wall resulting from the introduction of a mutation in the CCR1 and/or CCR3 genes. These mutations lead to the inactivation of these genes. The plants have up to 20% less lignin in their cell walls which	Proposed period of release: 15/04/2022 to 31/10/2023 Kein Final Report verfügbar. ³⁵⁵ Neuer Antrag: 15/04/2024 bis 31/10/2025 ³⁵⁶

353 <https://bensohill.com/#real-results>, <https://www.foodmanufacturing.com/capital-investment/news/21427448/crop-genomics-developer-benson-hill-to-go-public-through-spac-merger>

354 <https://ec.europa.eu/food/food-feed-portal/screen/gmob/search/details/POL-GMOB-IMPORT-10009>,
<https://ec.europa.eu/food/food-feed-portal/screen/gmob/search/details/POL-GMOB-IMPORT-10010>

355 <https://ec.europa.eu/food/food-feed-portal/screen/gmob/search/details/POL-GMOB-IMPORT-10014>

356 <https://ec.europa.eu/food/food-feed-portal/screen/gmob/search/details/POL-GMOB-IMPORT-10019>

Kultur	Verfahren ^{a)}	Eigenschaften	Unternehmen ^{b)}	Entwicklungs-status ^{c), d)}	Freisetzungsversuche
				is expected to contribute to a better digestibility of the maize thereby improving the feed conversion rate.	
Mais	CRISPR SDN-1	Scientific field evaluation of maize with modified growth characteristics	Vlaams Instituut voor Biotechnologie (VIB) (BEL)	The genetically modified maize plants have a mutation in the gene coding for a histon linkerprotein which leads to the inactivation of the gene. As a result, the plants have a significantly better growth during periods of drought.	Proposed period of release: 15/04/2022 to 31/10/2024 <u>Kein Final Report verfügbar</u> ³⁵⁷
Mais	CRISPR SDN-1	Scientific field evaluation of maize with increased resistance against DNA damage causing environmental stress	Vlaams Instituut voor Biotechnologie (VIB) (BEL)	The genetically modified maize plants have a significantly better growth under environmental stress conditions that lead to DNA damage.	Proposed period of release: 15/04/2022 to 31/10/2024 ³⁵⁸

357 <https://ec.europa.eu/food/food-feed-portal/screen/gmob/search/details/POL-GMOB-IMPORT-10011>,
<https://ec.europa.eu/food/food-feed-portal/screen/gmob/search/details/POL-GMOB-IMPORT-10015>

358 <https://ec.europa.eu/food/food-feed-portal/screen/gmob/search/details/POL-GMOB-IMPORT-10013>

Kultur	Verfahren ^{a)}	Eigenschaften	Unternehmen ^{b)}	Entwicklungsstatus ^{c), d)}	Freisetzungsversuche
Gerste	CRISPR	Altered Germination	Hartwick College, Center for Craft Food & Beverage (USA)	Anfrage nach Regulierungsstatus (Confirmation letter, SECURE) bei USDA ³⁵⁹	Nein
Kartoffel	CRISPR Transgenese	Potato with altered resistance to pathogens The long-term goal of the research is to gain knowledge about resistance to pathogens and how the plants' own sensitivity and resistance mechanisms work. The purpose of the release is to evaluate agricultural value, including resistance traits, under field conditions. We will also identify any morphological abnormalities, produce field-grown material for laboratory testing, and produce seed for next year's field trials.	Swedish University of Agricultural Sciences SLU, Department of Plant Protection Biology (SWE)	Freisetzungsversuch The experiment is only for research purposes³⁶⁰	Zwei Freisetzungsversuche: <u>2020 bis 2024</u>³⁶¹ und 2021 bis 2025
Kartoffel	CRISPR	CrisprCAS modified potato with altered starch properties	KMC Amba (DNK), University of Copenhagen (DNK)	The purpose of the release is to test the properties of the Waxy Wotan in	01/05/2023 to 30/09/2023

359 <https://www.aphis.usda.gov/biotechnology/downloads/confirmation-response/22-130-01cr-a2-request.pdf>

360 <https://ec.europa.eu/food/food-feed-portal/screen/gmob/search/details/POL-GMOB-IMPORT-10920>

361 <https://ec.europa.eu/food/food-feed-portal/screen/gmob/search/details/POL-GMOB-IMPORT-10918>

Kultur	Verfahren ^{a)}	Eigenschaften	Unternehmen ^{b)}	Entwicklungs- status ^{c), d)}	Freisetzungs- versuche
				agricultural land. Purpose is also to see the amount of modified starch and the quality of the starch, expected as a "Clean Label" product, and the growth of the plant. ³⁶²	<u>Kein Final Report verfügbar</u>
Kartoffel	CRISPR	CrisprCAS modified potato with altered sensitivity to blight <u>In 2024, the competent authority for environmental release of GMOs (The Danish Agricultural Agency) has received an application for experimental release of potatoes made with NBT which includes some of the same lines as mentioned above as well as new lines.</u> ³⁶³	KMC Amba (DNK), University of Copenhagen (DNK)	Short term goal is to evaluate the changed sensitivity to blight under field conditions with the expectation of a long term goal of reducing the use of fungicides in potatoes.	15/05/2023 to 30/09/2023 <u>Neuer Freisetzungs- antrag</u> (Dänemark): <u>10/04/2024 bis</u> <u>30/09/2026</u> ³⁶⁴ <u>Zwei Anträge</u> ³⁶⁵
Kartoffel	CRISPR	Krankheitsresistenz, Robustheit	Verbundprojekt ADLATUS (gefördert vom BMEL)	Forschung & Entwicklung ³⁶⁶	Geplant

362 <https://ec.europa.eu/food/food-feed-portal/screen/gmob/search/details/POL-GMOB-IMPORT-10145>

363 [https://one.oecd.org/document/ENV/CBC/MONO\(2024\)22/en/pdf](https://one.oecd.org/document/ENV/CBC/MONO(2024)22/en/pdf)

364 <https://ec.europa.eu/food/food-feed-portal/screen/gmob/search/details/POL-GMOB-IMPORT-10143>

365 <https://ec.europa.eu/food/food-feed-portal/screen/gmob/search/details/POL-GMOB-IMPORT-10144>

366 <https://www.bmel.de/SharedDocs/Pressemitteilungen/DE/2020/236-widerstandsfaeihige-kulturpflanzen.html>

Kultur	Verfahren ^{a)}	Eigenschaften	Unternehmen ^{b)}	Entwicklungs- status ^{c), d)}	Freisetzungs- versuche
Kartoffel	CRISPR	Veränderter Stärkegehalt	Lyckeby Starch AB (SWE)	Forschung & Entwicklung Long-term goals are variety testing and marketing. ³⁶⁷	2019 bis 2023 <u>Final Report verfügbar</u> ³⁶⁸
Kartoffel	CRISPR RNAi	Potato with altered resistance to pathogens	Swedish University of Agricultural Sciences SLU, Department of Plant Protection Biology (SWE)	The long-term goal is late blight and early blight resistance and to gain knowledge about plant resistance mechanisms. The experiment is only for research purposes. ³⁶⁹	2020 bis 2024 <u>Final Report verfügbar</u> ³⁷⁰

367 <https://ec.europa.eu/food/food-feed-portal/screen/gmob/search/details/POL-GMOB-IMPORT-10916>

368 https://webgate.ec.europa.eu/ffspm-manager/public/download?path=/gmo_b_auth/POL-GMOB-IMPORT-10916/gmobDocumentName_20241125121113_B-SE-19-5614-Final-Report.pdf&filename=B-SE-19-5614-Final-Report.pdf

369 <https://ec.europa.eu/food/food-feed-portal/screen/gmob/search/details/POL-GMOB-IMPORT-10918>

370 https://webgate.ec.europa.eu/ffspm-manager/public/download?path=/gmo_b_auth/AUTH-GMOB-IMPORT-10918/gmobDocumentFile_20250120022456_B%20SE%2020%201726.pdf&filename=B%20SE%2020%201726.pdf

Kultur	Verfahren ^{a)}	Eigenschaften	Unternehmen ^{b)}	Entwicklungs- status ^{c), d)}	Freisetzungs- versuche
Kartoffel NEU	CRISPR	Drei Traits: Potato with decrease in antinutritional compounds. Potato with tailored starch quality. Potato with decreased susceptibility to pathogens.	SolEdits AB (SWE)	The purpose of the release of gene edited potatoes is to; • Study any morphological changes that may arise via somatic variation as a result of in-vitro cultivation. • Study the yield of the lines and the starch content of the mature tubers as this is not possible in a greenhouse. • Study the lines' susceptibility to biotic and abiotic stress. • Extract starch from the tubers for further use in various application studies. Long-term goals might be variety testing and marketing.	10/04/2025 to 31/10/2029 ³⁷¹

371 <https://ec.europa.eu/food/food-feed-portal/screen/gmob/search/details/POL-GMOB-12105>

Kultur	Verfahren ^{a)}	Eigenschaften	Unternehmen ^{b)}	Entwicklungs-status ^{c), d)}	Freisetzungs-versuche
Kartoffel	CRISPR	Drei Traits: Potato with decrease in antinutritional compounds. Potato with tailored starch quality. Potato with decreased susceptibility to pathogens	Sveriges Lantbruksuniversitet, Umeå Plant Science Centre, Skoglig genetik och växtfysiolog (SWE)	The purpose of the release is to study any morphological changes that may arise via somatic variation as a result of in-vitro cultivation. ... Long-term goals are variety testing and marketing.	10/04/2023 bis 15/11/2027 ³⁷²
Kartoffel	Genome Editing (Ohne weitere Spezifizierung)	Altered Tuber Quality (bruising resistant)	Phytoform Labs Ltd. (GBR, USA) ³⁷³ Spin-off von Rothamsted Research	APHIS-Bescheid (Confirmation letter) ³⁷⁴	Unklar
Brokkoli	CRISPR	Molecular approaches to increase salinity and drought tolerance in broccoli - R17MOLBROC	Asociación Hortofrutícola Grupo Lucas (ESP)	The main objective of this project is to obtain broccoli lines with greater resistance to salinity and drought. With these field trials, to evaluate whether the edited material obtained using	Freisetzungs-versuch 01/04/2022 bis 28/02/2025 ³⁷⁵

372 <https://ec.europa.eu/food/food-feed-portal/screen/gmob/search/details/POL-GMOB-IMPORT-10921>

373 <https://www.phytoformlabs.com/about-us>

374 <https://www.aphis.usda.gov/biotechnology/downloads/confirmation-response/23-060-01cr-request.pdf>,
<https://www.aphis.usda.gov/biotechnology/downloads/confirmation-response/23-060-01cr-signed-response.pdf>

375 <https://ec.europa.eu/food/food-feed-portal/screen/gmob/search/details/POL-GMOB-IMPORT-10846>

Kultur	Verfahren ^{a)}	Eigenschaften	Unternehmen ^{b)}	Entwicklungs- status ^{c), d)}	Freisetzungs- versuche
				CRISPR/Cas9 technology is more resistant to salinity and drought, without repercussions on other commercial qualities. More specifically, to evaluate its agronomic suitability	
Tomate NEU	CRISPR	TEA/NGT-1 tomato lines for resistance to broomrape (Orobanche spp.)	Council for Agricultural Research and Economics - Research centre for Vegetable and Ornamental Crops (ITA)	Test in a field experiment the resistance of d27-KO1 and ccd7-KO1 to Phelipanche ramosa and evaluate the performance of such lines as rootstock for a commercial hybrid variety.	Antrag Freisetzungsver such (Italien): 13/05/2024 bis 31/12/2027 ³⁷⁶
Tomate	CRISPR	Erhöhter Vitamin D-Gehalt Übersichtsartikel mit Hinweis auf weitere Forschungsprojekte, die am gleichen Trait arbeiten. ³⁷⁷	John Innes Center (UK)	Researchers in Professor Cathie Martin's group at the John Innes Centre used CRISPR-Cas9 gene editing to make revisions to the genetic code of	Unklar

376 <https://ec.europa.eu/food/food-feed-portal/screen/gmob/search/details/POL-GMOB-IMPORT-10720>

377 <https://www.genengnews.com/topics/genome-editing/taste-the-sun-gene-editing-produces-vitamin-d-enhanced-tomatoes/>

Kultur	Verfahren ^{a)}	Eigenschaften	Unternehmen ^{b)}	Entwicklungs- status ^{c), d)}	Freisetzungs- versuche
				tomato plants so that provitamin D3 accumulates in the tomato fruit. ³⁷⁸	
Tomate	CRISPR	Früchte lösen sich ohne Stielansatz beim Pflücken Wissenschaftliche Publikation erschienen ³⁷⁹	University of Florida, Horticultural Sciences (USA)	APHIS-Bescheid 2018. Weiterer APHIS-Bescheid 2020 für neue Tomaten-Zuchtlinien (mit dem gleichen Trait) ³⁸⁰	Ja Ergebnisse der Freisetzungsversuche wurden veröffentlicht ³⁸¹
Tomate	CRISPR	Performing a proof-of-concept of a new method of rapid and efficient gene editing in a tomato plant ³⁸²	UC Davis Plant Biology Department (USA), TechAccel (USA) TechAccel nutzt Gene editing für die Entwicklung von disease-resistant crop varieties	TechAccel arbeitet u. a. mit Benson Hill zusammen ³⁸³	Geplant

378 <https://www.norwichresearchpark.com/gene-edited-tomatoes-could-be-a-new-source-of-vitamin-d>

379 <https://link.springer.com/article/10.1007/s13580-022-00489-5>

380 https://www.aphis.usda.gov/biotechnology/downloads/reg_loi/19-282-01-a3-air-inquiry-cbidel.pdf,
https://www.aphis.usda.gov/biotechnology/downloads/reg_loi/19-282-01-air-response-signed.pdf

381 <https://link.springer.com/article/10.1007/s13580-022-00489-5>

382 <https://biology.ucdavis.edu/news/stair-grant-funds-plant-biologists-efforts-create-cheaper-crispr-tech>

383 <https://techaccel.net/portfolio/>

Kultur	Verfahren ^{a)}	Eigenschaften	Unternehmen ^{b)}	Entwicklungs- status ^{c), d)}	Freisetzungs- versuche
Alfalfa/Luzerne	CRISPR	Herbizidresistenz “We combine Synthetic Biology and Gene Editing to develop herbicide resistant crops. Heurik™ , one of our technology platforms, integrates rational design and directed evolution to identify mutations which confers herbicide tolerance. Swap™ is the platform that introduces these mutations in crops using gene editing. The main advantages of this strategy is reducing development costs and time to market of our products. This is because we can work with elite lines and edit more than one gene at a time.”	Bioheuris (ARG, USA)	Forschung & Entwicklung. Es sind 3 verschiedene HR-Traits in Arbeit. ³⁸⁴ Currently, the focus of our alfalfa innovation program is the generation of integrated weed management systems in high-productivity cultivars. ³⁸⁵ Anfrage nach Regulierungs-status (Confirmation letter, SECURE) bei der USDA ³⁸⁶	Unklar
Sorghum	CRISPR	Improved disease resistance, nutritional value and enhanced resilience to biotic stresses ³⁸⁷ Wissenschaftliche Publikation	Corteva (USA), Donald Danforth Plant Science Center (USA)	Forschung & Entwicklung To combat Striga, a parasitic weed	Field trials of the new variety are scheduled for later this year

384 <https://www.bioheuris.com/en/what-we-do/>

385 <https://www.bioheuris.com/en/what-we-do/>

386 <https://www.aphis.usda.gov/biotechnology/downloads/confirmation-response/22-151-01cr-cbidel-a3-request.pdf>

387 <https://www.corteva.com/our-impact/innovation/crispr/our-promise.html>,
<https://www.pioneer.com/home/site/about/news-media/news-releases/template.CONTENT/guid.4AFC64D7-C550-96AF-405B-73B8C7879F29>

Kultur	Verfahren ^{a)}	Eigenschaften	Unternehmen ^{b)}	Entwicklungs-status ^{c), d)}	Freisetzungs-versuche
		erschienen. ³⁸⁸		without the use of herbicides, we have helped create sorghum that is resistant to Striga. ³⁸⁹	
Sorghum, (Perl-)Hirse	CRISPR	Productivity and quality improvements In some parts of the world, pearl millet flour is an important food staple. We have improved the quality and longevity of pearl millet flour by reducing the rancidity in the flour. ³⁹⁰	Corteva (USA), International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) (IND) ³⁹¹	Forschung & Entwicklung	Unklar
Sorghum	CRISPR	Multiple Traits, non-exclusive research license to evaluate five novel yield traits in forage sorghum ³⁹²	Yield10 Bioscience (USA), Forage Genetics (USA)	Forschung & Entwicklung Based on the field results obtained from our work with Camelina traits, we execute non-	Unklar

388 <https://pubmed.ncbi.nlm.nih.gov/32047036/>

389 <https://www.corteva.com/who-we-are/outlook/securing-food-through-sorghum.html>, https://www.nature.com/articles/d41586-024-00176-8?utm_medium=Social&utm_campaign=nature&utm_source=Twitter#Echobox=1706260106

390 <https://investors.corteva.com/static-files/c023a381-083e-4c92-8614-941419d4615a>

391 <https://www.icrisat.org/icrisat-and-corteva-agriscience-agriculture-division-of-dowdupont-collaborate-for-sharing-advanced-breeding-technologies-to-improve-crops-that-feed-millions/>

392 <https://ir.yield10bio.com/static-files/cb2ac804-60e9-440c-8b91-b449941643a3>, <https://www.globenewswire.com/en/news-release/2018/09/21/1574300/34378/en/Yield10-Bioscience-Grants-Research-License-to-Forage-Genetics-to-Evaluate-Novel-Yield-Traits-in-Sorghum.html>

Kultur	Verfahren ^{a)}	Eigenschaften	Unternehmen ^{b)}	Entwicklungs- status ^{c), d)}	Freisetzungs- versuche
				exclusive research licenses, enabling companies to evolve our traits within crops of interest. ³⁹³	
Cassava	CRISPR	Krankheitsresistenz	Corteva (USA), Donald Danforth Plant Science Center (USA), Virus Resistant Cassava for Africa (VIRCA) ³⁹⁴	Forschung & Entwicklung Forscher:innen (u. a. der ETH Zürich) weisen auf Schwierigkeiten bei Resistenzzüchtung mit CRISPR in Cassava hin. ³⁹⁵	Wahrscheinlich (Kenia, Uganda)
Teff	CRISPR	Verkürzte Stängellänge	Donald Danforth Plant Science Center (USA)	APHIS-Bescheid 2023 ³⁹⁶	Unklar
Hanf Badger G NEU	CRISPR	Badger G hemp does not contain cannabidiol (CBD) and tetrahydrocannabinol (THC), but contains higher levels of cannabigerol (CBG) ³⁹⁷	Wisconsin Crop Innovation Center (USA)	APHIS-Bescheid 2024	Unklar

393 <https://www.yield10bio.com/commitment/performance-traits#more>

394 <https://publications.jrc.ec.europa.eu/repository/handle/JRC123830>, S. 21, <https://allianceforscience.cornell.edu/blog/2021/08/gene-editing-key-to-improving-africas-staple-crops/>, <https://geneticliteracyproject.org/2022/09/13/crispr-tackles-deadly-cassava-mosaic-virus-disease/>

395 https://www.researchgate.net/profile/Devang-Mehta-3/publication/324963638_CRISPR-Cas9_interference_in_cassava_linked_to_the_evolution_of_editing-resistant_geminiviruses/links/5b02c4af4585154aeb06e99b/CRISPR-Cas9-interference-in-cassava-linked-to-the-evolution-of-editing-resistant-geminiviruses.pdf?origin=publication_detail

396 <https://www.aphis.usda.gov/brs/pdf/rsr/22-013-01rsr-review-submission.pdf>, <https://www.aphis.usda.gov/brs/pdf/rsr/22-013-01rsr-review-response.pdf>

Kultur	Verfahren ^{a)}	Eigenschaften	Unternehmen ^{b)}	Entwicklungs-status ^{c), d)}	Freisetzungs-versuche
Straucherbse (<i>Cajanus cajan</i>)	CRISPR	Herbizidresistenz This project aims to deliver (a) Herbicides resistant superior haplotypes; (b) Identify and use of homologs in pigeonpea genome for genome editing; (c) Generation of constructs with promoters, terminators and vectors for expression of Cas9 cassettes that may be extrapolated for other legumes/dicots; (d) The genome-edited lines with double herbicide tolerant trait shall be made available to researchers for further use in their crop improvement programmes. Growers will use these new technologies in combinations to fill in efficacy gaps of diversified weeds. ³⁹⁸	International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), International Centre for Genetic Engineering and Biotechnology (ICGEB)	Both institutes jointly submitted and won a competitive grant from Department of Biotechnology (DBT), Government of India entitled "Developing double herbicide tolerant pigeonpea for improved Weed management employing two pronged approach: haplotype mining in native germplasm and CRISPR/Cas9 mediated genome editing".	Nein
Sonnenblume	CRISPR	Herbizidresistenz	Bioheuris (ARG, USA), Argenetics (ARG)	Project to improve the integrated management of weeds in this crop.	Nein
Erdnuss	CRISPR	Herbizidresistenz	Bioheuris (ARG, USA)	Our research program seeks to	Nein

397 <https://bio.news/agriculture/bioengineered-hemp-with-reduced-thc-and-cbd-wins-regulatory-clearance/>, <https://innovativegenomics.org/news/crispr-in-agriculture-2024/>, <https://www.isaaa.org/kc/cropbiotechupdate/article/default.asp?ID=20767>

398 https://www.seedquest.com/news.php?type=news&id_article=135985&id_region=&id_category=&id_crop=

Kultur	Verfahren ^{a)}	Eigenschaften	Unternehmen ^{b)}	Entwicklungs- status ^{c), d)}	Freisetzungs- versuche
				develop safe and efficient ways to control them while protecting the crop.	
Kaffee	GEiGS® (Gene-Editing, RNAi)	Koffeinfreier Kaffee Video verfügbar ³⁹⁹	Tropic Bioscience (GBR)	We create natural low caffeine coffee by turning off the caffeine-producing genes within the bean. In replacing the usual aggressive chemical decaffeination process, we create coffee that is healthier and tastier for the consumer and easier on the supply chain. ⁴⁰⁰	Geplant
Kaffee	GEiGS® (Gene-Editing, RNAi)	Improved solubility	Tropic Bioscience (GBR)	Improving the solubility of the bean means higher quality, tastier coffee at lower processing temperatures - so, a lower energy cost for the planet. ⁴⁰¹	Unklar

399 <https://www.bloomberg.com/news/articles/2022-09-30/video-the-global-fight-to-save-coffee-from-climate-change?leadSource=uverify%20wall>

400 <https://tropic.bio/coffee/>

401 <https://tropic.bio/coffee/>

Kultur	Verfahren ^{a)}	Eigenschaften	Unternehmen ^{b)}	Entwicklungs- status ^{c), d)}	Freisetzungs- versuche
Kichererbse	ARCUS [®] genome-editing technology	Kichererbsenprotein als Fleischersatz, Kichererbse als «klimaangepasste» Pflanze	Elo Life Sciences (AUS), Queensland University of Technology (AUS) ⁴⁰²	Elo's ClimateSmart Chickpea program addresses the effect of climate change as a foundational trait for the plant-based protein industry. Edited chickpea plants were successfully created at a subsidiary of Elo in Australia. Genotypic and phenotypic screens are in progress. ⁴⁰³	Nein
Erbse NEU	CRISPR	Veränderter Geschmack	National Research Council, Canada (CAN) Das National Research Council arbeitet auch an: pea, chickpea, fava bean, lupine, lentil	The resulting gene-edited lines (of peas) have not yet been tested for their flavour profile. Even if they have an improved flavour profile, we won't commercialize them in the current cautious environment around gene editing. ⁴⁰⁴	Gewächshaus

402 <https://www.austrade.gov.au/ArticleDocuments/2833/elo-life-systems-case-study.pdf.aspx>

403 <https://elolife.ag/pipeline/>, <https://investor.precisionbiosciences.com/static-files/2de94543-7e05-4ffe-bf72-17e268cbefe4>

Kultur	Verfahren ^{a)}	Eigenschaften	Unternehmen ^{b)}	Entwicklungs- status ^{c), d)}	Freisetzungs- versuche
Tabak NEU	CRISPR	Development of a gene-edited tobacco line with high anatabine content	Asociación Empresarial de Investigación Centro Tecnológico Nacional Agroalimentario Extremadura (ESP)	The tobacco plants to be released carry mutations (deletions and insertions) in endogenous MPO genes. The mutations have been generated using the CRISPR / Cas9 system. These plants do not contain any transgene.	Freisetzungs- versuch (Spanien): 01/03/2024 bis 31/10/2024
Tabak	CRISPR	The tobacco plants to be released carry mutations (deletions and insertions) in different combinations of endogenous genes of the SPL family (SPL and FT-SPL lines), endogenous FT5 genes (FT and FT-SPL lines), endogenous MPO1 genes (MPO lines) or endogenous BBL genes (BBL lines). The mutations have been generated using the CRISPR / Cas9 system. These plants do not contain any transgene. ⁴⁰⁵	Instituto de Biología Molecular y Celular de Plantas, Agencia Estatal Consejo Superior de Investigaciones Científicas (ESP)	Forschung. Finaler Bericht liegt vor. ⁴⁰⁶	01.03.2021 bis 31.10.2021 CTAEX Experimental field, Villafranco del Guadiana, Badajoz (950m ²)

404 <https://www.producer.com/news/pulse-sector-goes-slow-on-gene-editing/>

405 https://gmoinfo.jrc.ec.europa.eu/gmp_report.aspx?CurNot=B/ES/21/01

406 https://webgate.ec.europa.eu/fip/GMO_Registers/files/finalreports/B-ES-21-01-Final-Report.pdf?dt=110123125122

Kultur	Verfahren ^{a)}	Eigenschaften	Unternehmen ^{b)}	Entwicklungs- status ^{c), d)}	Freisetzungs- versuche
Orange	CRISPR	Krankheitsresistenz	University of Florida, Institute of Food and Agricultural Sciences Citrus Research and Education Center (USA)	2022: APHIS-Bescheid (Confirmation letter) ⁴⁰⁷	Nein
Orange	TALEN	Toleranz gegen Zitruskrebs (<i>Xanthomonas citri</i>). Patentanmeldung (Anspruch auf Resistenzgen) läuft	2Blades Foundation (USA)	Forschung & Entwicklung. "We are testing three different independent mechanisms of resistance that are effective against <i>Xanthomonas</i> pathogens in other systems. ... 3) We are using gene-editing techniques to alter a susceptibility gene which is known to confer bacterial resistance in other plants." ⁴⁰⁸	Geplant

407 <https://www.aphis.usda.gov/biotechnology/downloads/confirmation-response/22-311-01cr-request.pdf>,
<https://www.aphis.usda.gov/biotechnology/downloads/confirmation-response/22-311-01cr-response-signed.pdf>

408 <https://2blades.org/projects-and-technology/projects/citrus-canker/>

Kultur	Verfahren ^{a)}	Eigenschaften	Unternehmen ^{b)}	Entwicklungs-status ^{c), d)}	Freisetzungs-versuche
Apfel	Cisgenese	Erhöhter Anthocyan-Gehalt	Stichting Dienst Land-bouwkundig Onderzoek (DLO) et al. (NLD)	Forschung ⁴⁰⁹	NL, 2016 - 2026
Physalis	CRISPR	Verschiedene: Fruchtgrösse, Vorerntefruchtfall, Invasivität	Physalis Improvement Project, Boyce Thompson Institute (USA)	Forschung & Entwicklung. 2020 Start eines Community Science Project ⁴¹⁰ Über Twitter erfährt man, dass auch 2022 Pflanzungen stattgefunden haben. ⁴¹¹	Ja
Kirsche	CRISPR	Kirschen ohne Steine	Pairwise Plants (USA)	Near the end of this decade, we plan to sell pitless cherries in grocery stores. If you're wondering why it takes so long, it's because we have to grow a new variety of cherry trees! ⁴¹² <u>Vermarktung ab 2030 möglich.</u> ⁴¹³	Unklar

409 <https://ec.europa.eu/food/food-feed-portal/screen/gmob/search/details/POL-GMOB-IMPORT-10752>

410 <https://btiscience.org/our-research/bti-physalis-project-2/>

411 <https://twitter.com/EliseTomaszews1/status/1532815989976481793>

412 <https://consciousfoods.net/process>

Kultur	Verfahren ^{a)}	Eigenschaften	Unternehmen ^{b)}	Entwicklungs-status ^{c), d)}	Freisetzungs-versuche
Weinrebe Chardonnay+ NEU	CRISPR	The inactivation of DMR6-1 and DMR6-2 genes in grapevine causes a slight increase in salicylic acid levels, a plant phytohormone that regulates defense mechanisms against pathogens.	Fondazione Edmund Mach	The purpose of the release is to verify the effective tolerance to downy mildew of the edited NGT-1 vines in open field conditions, and therefore the possibility to reduce the use of agrochemicals benefiting the environment, biodiversity, and the health of people living near vineyards.	Freisetzungs-versuch: 15/05/2025 bis 31/10/2030 ⁴¹⁴
Weinrebe NEU	CRISPR	Chardonnay variety, deleted in the DMR6.1 gene for resistance to grapevine downy mildew	EdiVite (ITA)	The release of TEA/NGT-1 grapevine plants aims to verify in open field conditions the resistance to the pathogen <i>Plasmopara viticola</i> , the causal agent of downy mildew, and consequently to assess the	Freisetzungs-versuch: 31/07/2024 bis 31/10/2028 ⁴¹⁵

413 <https://www.sueddeutsche.de/wirtschaft/crispr-kirsche-kernlos-genetik-1.6440119?reduced=true>

414 <https://ec.europa.eu/food/food-feed-portal/screen/gmob/search/details/POL-GMOB-IMPORT-10722>

415 <https://ec.europa.eu/food/food-feed-portal/screen/gmob/search/details/POL-GMOB-IMPORT-10721>

Kultur	Verfahren ^{a)}	Eigenschaften	Unternehmen ^{b)}	Entwicklungs- status ^{c), d)}	Freisetzungs- versuche
				possibility of reducing the use of phytosanitary products.	
Rutenhirse, Switchgras (<i>Panicum virgatum</i> L.)	CRISPR	Nutzung als Bioenergiepflanze Projektbeschreibung ⁴¹⁶ Interview mit der Entwicklerin ⁴¹⁷	University of Georgia, College of Agricultural & Environmental Sciences, Center for Applied Genetic Technologies (USA)	APHIS-Bescheid 2020. (Zeitgleich erging APHIS-Bescheid für gv-Rutenhirse, wahrscheinlich mit den gleichen Eigenschaften) ⁴¹⁸	Geplant
Pappel NEU	CRISPR	Im ersten Feldversuch (B/BE/24/V1) werden zwei gentechnisch veränderte Pappellinien getestet, bei denen durch die CRISPR/Cas9-Technologie Mutationen in das TRA2-Gen eingeführt wurden, die zu weniger Lignin und mehr Zellulose in der Zellwand führen. ⁴¹⁹ In dem anderen Feldversuch	Vlaams Instituut voor Biotechnologie (VIB) (BEL)	Neuer Antrag Die Feldversuche werden in Wetteren (Ostflandern) über einen Zeitraum von vier Jahren (bis Frühjahr 2028) auf einer Fläche von jeweils maximal 500 m ² durchgeführt.	2024 – 2028

416 https://genomicscience.energy.gov/wp-content/uploads/2022/01/Tuskan_IllaBerenguer_8_Revised.pdf

417 <https://research.uga.edu/news/katrien-devos-building-sustainable-transportation-on-fields-of-grass/>, <https://research.uga.edu/news/growing-our-gas-uga-moving-biofuels-closer-to-market/>

418 https://www.aphis.usda.gov/biotechnology/downloads/reg_loi/20-062-04_air_cbidel.pdf, https://www.aphis.usda.gov/biotechnology/downloads/reg_loi/20-062-04_air_response_signed.pdf

419 <https://ec.europa.eu/food/food-feed-portal/screen/gmob/search/details/POL-GMOB-IMPORT-10017>

Kultur	Verfahren ^{a)}	Eigenschaften	Unternehmen ^{b)}	Entwicklungsstatus ^{c), d)}	Freisetzungsversuche
		(B/BE/24/V2) werden drei gentechnisch veränderte Pappellinien getestet, bei denen die Lignin-zusammensetzung leicht verändert wurde ⁴²⁰			
Pappel (<i>Populus sp. and hybrids</i>)	CRISPR	Nutzung als Bioenergiepflanze A multidisciplinary team of researchers at the University of Georgia and two partner institutions have been awarded a \$15.8 million grant over five years from the U.S. Department of Energy to reengineer poplar trees (<i>Populus sp. and hybrids</i>) to be used as a sustainable energy source. ⁴²¹	University of Georgia, College of Agricultural & Environmental Sciences, Center for Applied Genetic Technologies (USA)	Forschung und Entwicklung.	Nein
Eukalyptus	CRISPR	FuturaGene intends to apply the gene editing technology to research and develop new varieties of eucalyptus that are more productive, resistant to	FuturaGene (USA), <u>Suzano (BRA)</u> ⁴²²	Ende 2021 wurde der Abschluss einer Lizenz zur Nutzung von CRISPR-Cas9 bekannt gegeben. ⁴²³	Nein

420 <https://www.health.belgium.be/nl/news/geef-uw-mening-over-twee-veldproeven-met-ggo-populieren>, <https://vib.be/en/news#/news/field-trial-applications-for-genetically-modified-poplars>, <https://ec.europa.eu/food/food-feed-portal/screen/gmob/search/details/POL-GMOB-IMPORT-10018>

421 <https://news.uga.edu/research-team-receives-15-8m-to-modify-poplar-for-bioproducts/>, <https://research.uga.edu/news/growing-our-gas-uga-moving-biofuels-closer-to-market/>

422 <https://www.futuragene.com/about-us/suzano-relationship/>

423 <https://www.businesswire.com/news/home/20211208005555/en/FuturaGene-Secures-License-to-CRISPR-Cas9-Technology-to-Develop-Sustainable-Varieties-of-Eucalyptus-with-Improved-Productivity-Stress-Resistance-and-Fiber-Quality>

Kultur	Verfahren ^{a)}	Eigenschaften	Unternehmen ^{b)}	Entwicklungs- status ^{c), d)}	Freisetzungs- versuche
		diseases and pests and have improved fiber properties. In addition, the company aims for the new varieties to be more resilient to climate change and to serve as an alternative to products derived from fossil fuels.		Wissenschaftliche Publikation erschienen. ⁴²⁴	
Pappel (populus trichocarpa x populus deltoides) NEU	CRISPR	Aspen as a model system	SweTree Technologies AB (SWE)	Basic research on tree biology	Freisetzungsversuch: 01/09/2024 bis 31/08/2029 ⁴²⁵
Grau-Pappel	CRISPR	Changes in lignin with directed mutagenesis	SweTree Technologies AB (SWE)	The aim of this experiment is to field test plants with CRISPR/Cas9-generated mutations that give a reduced level of lignin while maintaining normal growth of the plant, which have been shown in greenhouse experiments. ⁴²⁶	Proposed period of release: 01/05/2022 bis 31/12/2026

424 <https://onlinelibrary.wiley.com/doi/full/10.1002/pld3.507>

425 <https://ec.europa.eu/food/food-feed-portal/screen/gmob/search/details/POL-GMOB-IMPORT-10925>

426 <https://ec.europa.eu/food/food-feed-portal/screen/gmob/search/details/POL-GMOB-IMPORT-10919>

Kultur	Verfahren ^{a)}	Eigenschaften	Unternehmen ^{b)}	Entwicklungs- status ^{c), d)}	Freisetzungs- versuche
Arabidopsis	CRISPR	Photosynthesis and hormone biology	Umeå University, Dept. of chemistry (SWE)	Basic research on photosynthesis and hormone biology. ⁴²⁷	01/06/2023 to 30/09/2027

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) Unternehmen gelb hinterlegt = Zusatzinformationen im Begleitdokument.

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

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

427 <https://ec.europa.eu/food/food-feed-portal/screen/gmob/search/details/POL-GMOB-IMPORT-10924>

Lizenzvereinbarungen und Kooperationen

zwischen Züchtungs- und Biotech-Unternehmen – Start-Ups – Forschungseinrichtungen/Universitäten im Bereich der neuen gentechnischen Verfahren – landwirtschaftliche Anwendungen (2005 – 2025)

(UPDATE Stand: Januar 2025, neue Einträge sind unterstrichen)

→ Eine ausführliche Übersicht über Lizenzvereinbarungen und Patente (auch) im Bereich „Landwirtschaft“ liefert der Bericht: „CRISPR technology: Patent & License landscapes“, der im Auftrag des Swiss Federal Institute of Intellectual Property 2024 veröffentlicht wurde.¹

Lizenzgeber	Lizenznehmer	Verfahren	Jahr-Monat	Verwendungszweck	Quelle
Pairwise (USA)	Solis Agrosiences (USA)	Fulcrum™ Platform Tools (CRISPR)	<u>2024-06</u>	„Licensees of the Fulcrum Platform can receive access to Pairwise’s full suite of novel technologies and proprietary tools for applying CRISPR to research, develop, and commercialize products with differentiated plant genetics.“	86

¹ https://www.ige.ch/fileadmin/user_upload/recht/national/e/20231388_IPI_CRISPR_Patent_License_Landscape_revised_Final_16_02_24.pdf

Lizenzgeber	Lizenznehmer	Verfahren	Jahr-Monat	Verwendungszweck	Quelle
ToolGen (KOR)	Nullabio (KOR)	CRISPR-Cas9	2023-12	«ToolGen gab bekannt, dass es eine Vereinbarung zur Übertragung seiner CRISPR-Cas9-Gen-Editierungstechnologie an Nullabio, ein Unternehmen für Gen-Editierung von Nutzpflanzen, unterzeichnet hat. Im Rahmen der Vereinbarung erhält Nullabio das Recht, Toolgens CRISPR-Cas9-Geneditierungstechnologie auf Nutzpflanzen anzuwenden, um klimarelevante und gesundheitsfördernde Nutzpflanzen zu entwickeln, zu produzieren, zu lizenzieren und auf dem Weltmarkt zu vertreiben, und Toolgen erhält Lizenzgebühren, die gemäß der Vereinbarung zwischen den beiden Unternehmen nicht bekannt gegeben werden.»	84, 85
2Blades (USA)	NAPIGEN (USA)	TALEN	2023-10	“2Blades announced today the completion of a non-exclusive license agreement with NAPIGEN for access to 2Blades’ TALEN technology for applications in organellar genome editing. The editing of plant mitochondrial and chloroplast genomes opens new opportunities for altering traits in crop plants that have not yet been easily targeted by conventional methods (e.g., CRISPR/cas9), and which have significant implications for improved crop nutrition, growth, and yield.”	82

Lizenzgeber	Lizenznehmer	Verfahren	Jahr-Monat	Verwendungszweck	Quelle
Corteva Agriscience (USA) Broad Institute (USA)	Harpe Bioherbicide Solutions, Inc. (USA)	CRISPR-Cas9	2023-09	"Harpe Bioherbicide Solutions, Inc., an agricultural technology company focused on providing natural and sustainable herbicide solutions, announced today that it has executed a joint intellectual property licensing agreement with Corteva Agriscience and the Broad Institute of MIT and Harvard for foundational CRISPR-Cas9 and related gene editing tools to further research and develop Harpe Bioherbicide tolerant crop systems."	83
Merck KGaA, Life Science division, MilliporeSigma	BetterSeeds Ltd. (ISR)	CRISPR	2022-03	"Merck KGaA, a leading multinational Pharmaceutical company, has signed through its <i>Life Science</i> division, MilliporeSigma, a unique collaboration and license agreement with an Israeli AgTech company to demonstrate the utility of its proprietary CRISPR genome-editing tools in agricultural uses. The agreement licenses its foundational CRISPR intellectual property to Israeli BetterSeeds Ltd., a disruptive company that uses genome editing technology including CRISPR to develop new breeds of plants."	79
Corteva Agriscience (USA) Broad Institute (USA)	Sustainable Oils (USA)	CRISPR-Cas9	2022-08	"Sustainable Oils, Inc., a wholly owned subsidiary of Global Clean Energy Holdings, Inc., an ultra-low carbon renewable fuel company that will use nonfood camelina as their primary fuel source material, today announced a joint licensing agreement with Corteva Agriscience and the Broad Institute of MIT and Harvard for CRISPR-Cas9 and related gene editing tools to further develop their patented camelina varieties."	81

Lizenzgeber	Lizenznehmer	Verfahren	Jahr-Monat	Verwendungszweck	Quelle
<i>Corteva Agriscience (USA)</i> <i>Broad Institute (USA)</i>	<i>FuturaGene (USA)</i>	CRISPR-Cas9	2021-12	“FuturaGene, a wholly owned subsidiary of world-leading eucalyptus pulp producer, Suzano, will use patented genome editing technology from global pure-play agriculture company, Corteva Agriscience, and non-profit research organization, the Broad Institute of MIT and Harvard, to develop new, improved eucalyptus varieties. FuturaGene intends to apply the gene editing technology to research and develop new varieties of eucalyptus that are more productive, resistant to diseases and pests and have improved fiber properties. In addition, the company aims for the new varieties to be more resilient to climate change and to serve as an alternative to products derived from fossil fuels. FuturaGene has the option to convert the worldwide research license to cover commercial applications.”	80
<i>Corteva Agriscience (USA)</i> <i>Broad Institute (USA)</i>	<i>Bejo (NL)</i>	CRISPR-Cas9	2021-05	“Dutch vegetable seed breeder Bejo has entered into a non-exclusive research and commercial license agreement with global agriculture company Corteva Agriscience and the Broad Institute of MIT and Harvard, a U.S.-based biomedical and genomic research center. Through the agreement, Bejo will access CRISPR-Cas9 intellectual property for genome editing for agricultural use, allowing research work and programs as well as potential future commercial applications. For the time being, however, following the development in legislation Bejo will use CRISPR-Cas9-technology for research purpose only..”	78

Lizenzgeber	Lizenznehmer	Verfahren	Jahr-Monat	Verwendungszweck	Quelle
<i>Tropic Bioscience</i>	<i>BASF</i>	GEiGS™ (Gene Editing induced Gene Silencing)	2020-07	“Tropic Biosciences announces their research agreement with BASF to utilize Tropic’s ground-breaking GEiGS™ (Gene Editing induced Gene Silencing) technology to develop traits to address growers’ most critical challenges in protecting crops. The collaboration applies the Tropic Bioscience GEiGS™ platform within BASF’s strategic crop varieties and utilizes BASF’s expertise in the development of agricultural traits. GEiGS™ technology utilizes established genome editing tools to make precise and specific changes to only a few nucleotides within non-coding genomic locations of a host organism. These changes redirect RNA interference (RNAi, also Gene Silencing) activity of non-coding genes towards target genes, including those belonging to pathogens and pests. The approach does not depend on the introduction of foreign genes into the host genome.”	75
<i>University of Minnesota (USA)</i>	<i>Calyxt (USA)</i>	Fast-TrACC	2020-04	Calyxt “has licensed a new method to help increase plant gene editing efficiency from the University of Minnesota. The method has the potential to reduce the time needed to edit plants from approximately one year to several months. This breakthrough, co-invented by Dan Voytas, Ph.D., the co-founder of Calyxt and the University of Minnesota Professor of Genetics, Cell Biology and Development (...) This new technology could help Calyxt bring consumer-desired products, like better tasting plant proteins, to the market faster.”	72, 73, 74

Lizenzgeber	Lizenznehmer	Verfahren	Jahr-Monat	Verwendungszweck	Quelle
<i>Broad Institute of MIT and Harvard</i>	<i>Monsanto Company/BAYER Crop Science</i>	CRISPR-Cpf1	2020-03	“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. (...) Over the last year, Monsanto has licensed multiple genome-editing technologies – including a separate license from the Broad Institute for use of the CRISPR-Cas9 system in agriculture – to develop a leading portfolio of tools in this field. The intellectual property around the CRISPR-Cpf1 system is independent from the CRISPR-Cas patent estate, and this CRISPR-Cpf1 license provides Monsanto with another valuable tool for genome editing in this rapidly advancing field of science. Under the new agreement announced, the Broad Institute grants Monsanto a worldwide non-exclusive license for agricultural applications of the CRISPR-Cpf1 system. Additional terms of the agreement were not disclosed.”	77
<i>Corteva Agriscience (USA)</i> <i>Broad Institute (USA)</i>	<i>Vilmorin & Cie (FRA)</i>	CRISPR-Cas9	2019-12	“This non-exclusive license agreement grants Vilmorin & Cie access to certain CRISPR-Cas9 patents covering genome editing tools for agricultural use. The license agreement covers all Vilmorin & Cie's research work and programs as well as potential commercial applications. Vilmorin & Cie will be able to deploy this technology for both its Field Seeds and Vegetable Seeds activities.”	69, 70, <u>76</u>
<i>Benson Hill Biosystems (USA)</i>	<i>Rice Tec (USA)</i>	CRISPR-Cms1	2019-06	“...announcing the licensing agreement for the use of Benson Hill's technologies as part of RiceTec's rice research and development operations.”	62

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Corteva Agriscience (USA) Broad Institute (USA)	Amfora (USA)	CRISPR-Cas9	2019-04	“Amfora, a biotechnology company, announced it has reached a non-exclusive research and commercial license agreement with Corteva Agriscience™, the Agriculture Division of DowDuPont™, and the Broad Institute of MIT and Harvard. Through the agreement, Amfora will use intellectual property covering CRISPR-Cas9 and related gene editing tools to develop a portfolio of gene-edited crops with increased protein content.”	64
Cold Spring Harbour (USA)	Inari (USA)	CRISPR-based tool for editing promoters	2019-04	“... announced today an exclusive licensing agreement with partner Inari, a company that is advancing plant breeding by tapping nature’s genetic diversity. The technology developed by CSHL Professor and Howard Hughes Medical Institute Investigator Zachary Lippman allows Inari to tailor plant architecture and other traits in crops, improving productivity and quality to fit local environmental conditions.”	65, 67
Massachusetts General Hospital (USA)	Pairwise (USA)	CRISPR	2019-03	“The agreement with MGH reflects Pairwise’s commitment to finding and applying the right tools to deliver best-in-class solutions. Pairwise has the exclusive license to specific MGH CRISPR technology and will further develop applications for agriculture.”	63

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<i>Broad Institute (USA)</i>	<i>Pairwise (USA)</i>	CRISPR-Cas9, - Cas12	2019-03	“The agreement with the Broad Institute gives Pairwise a license to the Cas9 and Cas12 (including both Cas12a/Cpf1 and Cas12b/C2c1) patent portfolios for use in plants and agriculture. The Broad Institute licenses are non-exclusive and adhere to the Broad Institutes's ethical restrictions for agricultural use, which prohibit using CRISPR for gene drive, sterile seeds, or tobacco products for human use.“	63
<i>University of California (USA)</i>	<i>Inari (USA)</i>	Patents that describe key epigenetic pathways in plants and methods based on CRISPR for altering DNA methylation and gene regulation.	2019-02	“Inari, a company that is revolutionizing plant breeding by tapping natural genetic diversity, announced it has secured exclusive patent licenses for epigenetics from the University of California, Los Angeles (UCLA). The agreement, through UCLA's Technology Development Group, gives Inari access to tools that will positively influence crop performance without altering a plant's genetic code.”	66, 67
<i>Broad Institute (USA)</i>	<i>Vilmorin & Cie (FRA)</i>	CRISPR-Cpf1	2018-12	“..at the beginning of fiscal year 2018-2019, Vilmorin & Cie signed an agreement enabling it to broaden its range of technologies, by accessing the CRISPR genome editing technique, in order to use it in all its breeding work, both for Vegetable Seeds and Field Seeds. For this purpose, Vilmorin & Cie signed an agreement with the Broad Institute of MIT and Harvard biomedical and genomic research center located in Cambridge in the United States. This agreement grants Vilmorin & Cie access to the technique known as CRISPR-Cpf1; it covers uses both for purposes of research and for potential commercial applications.”	69, 71

Lizenzgeber	Lizenznehmer	Verfahren	Jahr-Monat	Verwendungszweck	Quelle
<i>Two Blades Foundation (2Blades) (USA)</i>	<i>Epicrop Technologies Inc. (USA)</i>	TAL code technology	2018-11	Non-exclusive licence agreement. “We are pleased to be able to utilize this technology in our research to 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 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.”	61
<i>Broad Institute (USA)</i>	<i>BASF (DEU)</i>	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 to improve products in agricultural and industrial microbiology applications .”	57

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<i>Corteva Agriscience™, Agriculture Division of DowDuPont™, Broad Institute (USA)</i>	<i>J. R. Simplot (USA)</i>	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
<i>Corteva Agriscience™, Agriculture Division of DowDuPont™, Broad Institute (USA)</i>	<i>Yield10Bioscience (USA)</i>	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
<i>Corteva Agriscience™, Agriculture Division of DowDuPont™, Broad Institute (USA)</i>	<i>ICRISAT, The International Crops Research Institute for the Semi-Arid Tropics (India)</i>	CRISPR-Cas9	2018-04	“The technology sharing includes CRISPR-Cas gene editing, adapting transformation techniques to new crops, and applying knowledge of plant biochemical pathways with the goal of productivity and quality improvements for crops that feed millions of people. DuPont Pioneer, now part of Corteva Agriscience™, will provide access to intellectual property, material and know-how related to CRISPR-Cas and plant transformation.”	68

Lizenzgeber	Lizenznehmer	Verfahren	Jahr-Monat	Verwendungszweck	Quelle
<i>Precision BioScience (USA)</i>	<i>Cargill (USA)</i>	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
<i>Broad Institute (USA)</i>	<i>Syngenta (China, CH)</i>	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

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<i>Broad Institute (USA)</i> + <i>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</i>	<i>DuPont Pioneer (USA)</i>	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
<i>Broad Institute (USA)</i>	<i>Arcadia Bioscience Inc. (USA)</i>	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

<i>Lizenzgeber</i>	<i>Lizenznehmer</i>	<i>Verfahren</i>	<i>Jahr-Monat</i>	<i>Verwendungszweck</i>	<i>Quelle</i>
<i>ToolGen (USA)</i>	<i>Monsanto (USA)</i>	CRISPR-technology platform	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
<i>DuPont Pioneer (USA)</i>	<i>ERS Genomics</i>	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

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<i>Broad Institute (USA)</i>	<i>BASF (Germany)</i>	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
<i>Broad Institute (USA)</i>	<i>Monsanto (USA)</i>	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
<i>Two Blades Foundation (2Blades) (USA)</i>	<i>International Rice Research Institute (IRRI) (Philippines)</i>	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
				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

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<i>Broad Institute</i> (USA)	<i>Monsanto Company</i> (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
<i>TargetGene Biotechnologies LTD</i> (Israel)	<i>Monsanto Company</i> (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
<i>Nomad Bioscience GmbH</i> (D)	<i>Monsanto Company</i> (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

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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
<i>Institute of Genetics and Developmental Biology (IGDB), Chinese Academy of Sciences (China)</i> via <i>Plant Bioscience Limited (PBL) (UK)</i>	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. <i>Plants with new traits in wheat, rice and corn are currently at various stages of development using gene-editing technology and include quality improvement and yield increase traits.</i>”	10

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Arcadia Biosciences, Inc. (USA)	Dow AgroSciences LLC (USA)	EXZACT™ Precision Technology Platform (ZFN)	2015-12	„Arcadia Biosciences, Inc. (...) and Dow AgroSciences LLC (...) announce a strategic collaboration to 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

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Dow AgroSciences (USA)	<i>Institute of Crop Sciences, Chinese Academy of Agricultural Sciences</i> (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
<i>Vilnius University, Institute of Biotechnology</i> (Lithuania)	<i>DuPont Pioneer</i> (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 <i>for all commercial uses, including in agriculture.</i> ”	8

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Dow AgroSciences (USA)	Department of Environment and Primary Industries (DEPI) via Agriculture Victoria Services Pty Ltd. (Australia)	EXZACT™ Precision Technology platform (ZFN)	2015-05	„The Department of Environment and Primary Industries (DEPI) of the State of Victoria, Australia, through its commercial arm, Agriculture Victoria Services Pty Ltd. (AVS), strengthened a 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
Two Blades Foundation (2Blades) (USA)	Cellectis plant sciences, Inc. (FRA)	TAL Nuclease Technologies (TALEN)	2014-12	“...announced the execution of a non-exclusive cross-license agreement relating to TAL nuclease technologies. Pursuant to the agreement, 2Blades receives a license to TALEN™ technology 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
	⇔ Kreuzlizenzierung				

Lizenzgeber	Lizenznehmer	Verfahren	Jahr-Monat	Verwendungszweck	Quelle
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
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, <i>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</i> of the EXZACT Precision Technology <i>to enable precision transformation, trait stacking and targeted mutagenesis in plants.</i> ”	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 <i>have successfully generated site-specific genome modifications in petunia and jasmine tobacco</i> 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
Precision BioSciences (USA)	Agrivida (USA)	Directed Nuclease Editor™ (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 Editor™ (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 to 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
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
Collectis plant sciences (FRA) $\rightleftharpoons$	Precision BioSciences (USA) Kreuzlizenzierung	Meganuclease technology	2014-01	“Precision BioSciences, Inc. and Collectis SA (...) announced that they have reached an agreement to settle patent litigation involving engineered I-Crel 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-Crel meganuclease genome engineering field.”	30

Lizenzgeber	Lizenznehmer	Verfahren	Jahr-Monat	Verwendungszweck	Quelle
<i>Cellectis plant sciences</i> (FRA)	<i>Bayer CropScience</i> (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
<i>Two Blades Foundation (2Blades)</i> (USA)	<i>DuPont Pioneer</i> (USA)	TAL Effector Technology (TALEN)	2012-12	“2Blades continues broad license access to its award-winning TAL technology through a non-exclusive license to Dupont Pioneer for uses in certain crops. Improvements to the technology will be granted back for 2Blades’ humanitarian projects benefiting subsistence farming.”	22
<i>Iowa State University</i> (USA)	<i>Cellectis plant sciences, Inc.</i> (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
<i>Two Blades Foundation (2Blades) (USA)</i>	<i>Monsanto Company (USA)</i>	TAL Nuclease Technologies (TALEN)	2012-09	“2Blades announces the expansion of rights to Monsanto under our non-exclusive license, announced in April, 2012, for 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
<i>Two Blades Foundation (2Blades) (USA)</i>	<i>KWS SAAT AG (D)</i>	TAL Nuclease Technologies (TALEN)	2012-07	“Two Blades Foundation (2Blades) has completed a non-exclusive license agreement with KWS SAAT AG (KWS) for access to 2Blades’ Transcription Activator Like (TAL) effector code technology for genome engineering in certain crops . KWS will grant improvements in the technology back to 2Blades for subsistence farming applications.”	42
<i>Two Blades Foundation (2Blades) (USA)</i>	<i>Bayer CropScience (D)</i>	TAL Nuclease Technologies (TALEN)	2012-05	“2Blades is pleased to announce completion of a non-exclusive license agreement with Bayer CropScience for the TAL code genome engineering technology. 2Blades will receive improvements to the TAL code for use in its subsistence farming applications.”	44
<i>Two Blades Foundation (2Blades) (USA)</i>	<i>Monsanto Company (USA)</i>	TAL Nuclease Technologies (TALEN)	2012-04	“The Two Blades Foundation (2Blades) has completed a non-exclusive license agreement with the Monsanto Company for access to the TAL Code technology 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
<i>Two Blades Foundation (2Blades) (USA)</i>	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
<i>Martin-Luther-University Halle-Wittenberg (D)</i> via <i>Two Blades Foundation (2Blades) (USA)</i>	<i>Life Technologies Corporation</i> (seit 2014 zu: <i>ThermoFisher Scientific</i>) (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
<i>Martin-Luther-University Halle-Wittenberg (D)</i>	<i>Two Blades Foundation (2Blades) (USA)</i>	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
<i>Dow AgroSciences (USA)</i>	<i>Oregon State University (USA)</i>	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
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
University of Minnesota	Collectis (FRA)	Inventions related to TAL effector-mediated DNA recognition and cleavage (TALEN)	2011-01	“Collectis (...), the French genome engineering specialist, has announced today that it has signed an exclusive license agreement with the University of Minnesota that grants Collectis the worldwide right to use inventions related to TAL effector-mediated DNA recognition and cleavage. This revolutionary approach for the targeted modification of genomes was developed by the University of Minnesota and Iowa State University. The exclusive license granted to Collectis 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
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
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
Collectis (FRA)	Monsanto Company (USA)	Meganuclease technology	2009-09	“Monsanto Company (...) today announced a non-exclusive research and commercial license agreement with Collectis S.A. (...) for broad use of its meganuclease technology in plants . (...) Under the agreement, Monsanto will have access to Collectis’ intellectual property on meganucleases and its custom meganuclease production platform. Collectis will receive an upfront payment of €3 million, and subject to the approval of the Extraordinary General Meeting of Collectis’ shareholders, Monsanto will make an equity investment of €1 million to allow Collectis to scale the technology for agriculture. Collectis will also be eligible to receive fees for the development of each meganuclease, success-based milestones and may receive royalties on certain traits commercialized by Monsanto.”	16

Lizenzgeber	Lizenznehmer	Verfahren	Jahr-Monat	Verwendungszweck	Quelle
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
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) 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

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