



The power of genome editing requires that it connects social and technical conditions as well as science. It can enhance and improve the quality of life of people and animals, address critical issues and contribute to the sustainable growth of the world's food, fiber, and environmental systems.

ABSTRACT
Genome editing is a powerful tool that can be used to improve the quality of life of people and animals, address critical issues and contribute to the sustainable growth of the world's food, fiber, and environmental systems. This paper discusses the science, social, and technical conditions that are necessary for the successful use of genome editing in agriculture. It also provides a framework for the development of policies and regulations that will ensure the safe and effective use of genome editing in agriculture.

INTRODUCTION

Genome editing is a powerful tool that can be used to improve the quality of life of people and animals, address critical issues and contribute to the sustainable growth of the world's food, fiber, and environmental systems. This paper discusses the science, social, and technical conditions that are necessary for the successful use of genome editing in agriculture. It also provides a framework for the development of policies and regulations that will ensure the safe and effective use of genome editing in agriculture.

CAST Issue Paper 60

Genome Editing in Agriculture: Methods, Applications, and Governance

Released July 9, 2018

Chair: Adam Bogdanove, Cornell University; 10-member task force

Release/Rollout

On July 9, Dr. Adam Bogdanove, the task force chair, gave a presentation to an audience at The Association of Public and Land-grant Universities offices. He then conducted briefings for House staffers at a noon National Coalition for Food and Agricultural Research (NC-FAR) lunch seminar, which was followed by a presentation to Senate staffers in the afternoon, also in coordination with NC-FAR.

Approximately 70 attended these three briefings.

In-kind Contributions: 260 volunteer hours; \$19,240 monetary value

Press Release (results two weeks after release)

- Press release went to 8,771 e-contacts (3,322 media) resulting in 4,239 opens/interactions
- 299,613 headline impressions, 1,448 media deliveries, and 149 online pickups on [press release through PRWeb](#).
- A sampling of sites where the release was picked up: AgriMarketing, AgriTech Tomorrow, ASPB Plant Science today, B4FA Biosciences for Farming in America, BioPortfolio, Dairy Business, Genetic Engineering and Society Center, Hawaii News Now, International Service for the Acquisition of Agri-biotech Applications, Iowa State University CALS (July 2, 2018 newsletter), Lancaster Farming, One News Page (United Kingdom), Oklahoma Farm Report, PortalTaxi, The Bullvine, and several news channel affiliates.

Follow-On Activities

- Video of Dr. Bogdanove's presentation and slides posted on CAST website and YouTube. [Click here to view](#). (493 views as of July 9, 2020)

Paper Distribution: 12,224

- [Issue Paper and Ag quickCAST](#) Downloads—2 years after release: 11,447
- Distributed more than 900 copies of printed issue paper (as of July 24, 2018)

Indirect Paper Distribution

ACSESS Digital Library

<https://dl.sciencesocieties.org/issue-papers>

BGF biotech-gm-food, July 9, 2018

<https://www.biotech-gm-food.com/presseschau-juli-2018>

This report last updated 7/9/2020.

DairyProducer.ca, July 11, 2018 (posted Ag quickCAST)

<http://dairyproducer.ca/genome-editing-in-agriculture-methods-applications-and-governance/>

Context, Fall 2018

<https://contextnet.com/gene-editing-how-will-european-ruling-impact-this-potent-game-changer-in-the-us/>

Gen Au Rheinau, Saatschutz für die Welt von morgen (Translation: Seed protection for the world of tomorrow), September 9, 2018

<https://gen-au-rheinau.ch/aktuelles/>

https://gen-au-rheinau.ch/wp-content/uploads/2018/09/CAST_2018_Gene_Editing.pdf

HIGH AGRICULTURAL TECHNOLOGY RESEARCH INSTITUTE FOR MEKONG DELTA, September 14, 2018

<http://hatri.org/en/-notification/announcementresults-training-workshop-invinh-long-sweet-potato/n1025.mt24h>

North Carolina State University, Genetic Engineering and Society Center. Publications by affiliated faculty and students. (link to paper)

<https://research.ncsu.edu/ges/publications/faculty-publications/>

SemanticScholar.org

<https://www.semanticscholar.org/paper/Genome-Editing-in-Agriculture-%3A-Methods-%2C-%2C-and-A-Bogdanove/55e82cff4693d1425ec8e237db7b9b86730c96c8>

Personal Mentions

Lee Van Wychen—Executive Director of Science Policy, National and Regional Weed Science Societies (rollout attendee)

Mentioned it in several meetings with agency staff and circulated a summary to members of the Weed Science Society of America, North Central Weed Science Society, Northeastern Weed Science Society, Southern Weed Science Society, and Western Society of Weed Science via newsletter.

Articles and Web Mentions

AgriPulse, July 11, 2018

<https://www.agri-pulse.com/articles/11204-ag-scientists-draw-a-road-map-for-gene-editing>

AgBiotech NC State Extension, July 11, 2018

<https://agbiotech.ces.ncsu.edu/2018/07/cast-issue-paper-genome-editing-in-agriculture-methods-applications-and-governance/>

Biotechnology and Innovation, CiB Blog - Biotechnology Information Center, Portugal, May 8, 2019,

<https://cibpt.wordpress.com/tag/edicao-de-genoma/>

Bovine Veterinarian, July 10, 2018

<https://www.bovinevetonline.com/article/gene-editing-potential-and-perceptions-0>

Cornell University College of Agriculture and Life Sciences, School of Integrative Plant Science

Recent publications from the SIPS community – July 19, 2018

<https://blogs.cornell.edu/sips/page/7/>

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Crop Biotech Update, July 11, 2018

<http://www.isaaa.org/kc/cropbiotechupdate/article/default.asp?ID=16600>

Dairy Herd Management, July 9, 2018

<https://www.dairyherd.com/article/gene-editing-potential-and-perceptions>

Drovers, July 10, 2018

<https://www.drovers.com/article/gene-editing-potential-and-perceptions>

Farm Journal AgTech, July 17, 2018

preferences.farmjournal.com/index.php/email/emailWebview?mkt_tok=eyJpIjoiWkRZeU5HRmxNREI6TmJiMCIsInQiOiIiRWDY0SHhlekR6c3dkTFNpSmFid0c4MzIXQWxUQ0lkZHpYRzQwaXFOMHpKcIIIQ0xBVpYSUt0RGNURTMvaHczb0ZFaUxzL1Y5eJpU0ZKbDZhzZzE2NWE3U3dQnplSTMRcUwyZ3Y2ZUVSOFBtK2VNm3BkS3hxVEJNT2NtZDdZUCJ9

Farm Journal's Pork, July 18, 2018

<https://www.porkbusiness.com/article/gene-editing-potential-and-perceptions>

Fundación Antama, Nuevo documento (en inglés) en el que se explican las claves de la mejora genética en agricultura (Translation: New document (in English) in which the keys of genetic improvement in agriculture are explained), August 21, 2018

<http://fundacion-antama.org/nuevo-documento-en-ingles-en-el-que-se-explican-las-claves-de-la-mejora-genetica-en-agricultura/>

The In Vitro Report, A Publication of the Society for In Vitro Biology, October 1, 2018

<https://www.sivb.org/InVitroReport/issue-52-3-july-september-2018/cast-gene-editing-paper-presented-at-2018-sivb-meeting/>

National Coalition for Food and Agricultural Research, Highlights from 2018 Hill Seminar Series, December 26, 2018

https://www.ncfar.org/NC-FAR_Hill_Seminars_Highlights.pdf

Citations

Asian Biotechnology & Development Review, Vol. 20 Issue 1/2, p89-97, *Regulating Genome Edited Crops and European Court of Justice Ruling*, Mar-Jul 2018.

<https://web.a.ebscohost.com/abstract?direct=true&profile=ehost&scope=site&authtype=crawler&jrnl=09727566&AN=133492493&h=lghDraCSea8p%2f17CRKLe7vGWut0S%2b9HGZEIPRIUDQa0H74lm9NWxEP6EYnEQqjYtWBb6KEUycnsCNuNmhS82fw%3d%3d&crI=c&resultNs=AdminWebAuth&resultLocal=ErrCrIAuth&crIhashurl=login.aspx%3fdirect%3dtrue%26profile%3dehost%26scope%3dsite%26authtype%3dcrawler%26jrnl%3d09727566%26AN%3d133492493>

Current Research in Biotechnology, Volume 1, November 2019, Pages 11-21, *Risk and safety considerations of genome edited crops: Expert opinion*

<https://www.sciencedirect.com/science/article/pii/S2590262819300024>

Food Next, *Doing so makes the crops healthier! "Emerging Precision Breeding Technologies" being researched by agriculture around the world!* (translated title), 5/10/2019

<https://www.foodnext.net/science/technology/paper/5616371667>

Frontiers in Bioengineering and Biotechnology, *Familiarity in the Context of Risk Assessment of Transgenic Crops: Focus on Some Countries in the Americas*, January 28, 2020

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6997124/>

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Journal AgroBiogen, *Genome-Edited Plants and the Challenges of Regulating Their Biosafety in Indonesia*, Volume 15, December 2019

https://www.researchgate.net/publication/338342782_Genome-Edited_Plants_and_the_Challenges_of_Regulating_Their_Biosafety_in_Indonesia

Journal of Law and Bioscience, *Genetic identity concerns in the regulation of novel reproductive technologies*, April 20, 2020

<https://academic.oup.com/jlb/article/doi/10.1093/jlb/lcaa004/5822692>

New Phytologist, *A comparison of the EU regulatory approach to directed mutagenesis with that of other jurisdictions, consequences for international trade and potential steps forward*, December 13, 2018

<https://nph.onlinelibrary.wiley.com/doi/full/10.1111/nph.15627>

Social Media

Facebook—

Mid America CropLife Association, October 21, 2019

<https://www.facebook.com/MACroplifeA/posts/3060070850734229>

Mid America CropLife Association, July 26, 2019

<https://www.facebook.com/MACroplifeA/posts/2819051058169544>

CAST, July 14, 2018

<https://www.facebook.com/CASTagScience/posts/1815690338525754>

Antonio Luiz, July 9, 2018

https://www.facebook.com/permalink.php?story_fbid=229645517693747&id=100019449015491

Agri-Pulse Communications, Inc, July 16, 2018

<https://www.facebook.com/AgriPulseDC/posts/2004397159570946>

Biosafety South Africa, July 11, 2018

<https://www.facebook.com/biosafetysouthafrica/posts/1735114749889973>

Biosciences for Farming in Africa—B4FA, July 11, 2018

<https://www.facebook.com/2015B4FA/posts/1757093821042488>

CAST, July 9, 2018

<https://www.facebook.com/CASTagScience/posts/1803574296404025>

1 like and 1 share

CAST, July 5, 2018

<https://www.facebook.com/CASTagScience/posts/1803529773075144>

1 like

CAST, July 1, 2018

<https://www.facebook.com/CASTagScience/posts/1794003824027739>

CAST, June 29, 2018

<https://www.facebook.com/CASTagScience/posts/1793848807376574>

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CAST, June 25, 2018

<https://www.facebook.com/CASTagScience/posts/1788439471250841>

2 likes and 1 share

CAST, June 15, 2018

<https://www.facebook.com/CASTagScience/posts/1772999292794859>

1 like

CAST, July 10, 2018

<https://www.facebook.com/CASTagScience/posts/1811057915655663>

CAST, July 11, 2018

<https://www.facebook.com/CASTagScience/posts/1812875135473941>

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<https://www.facebook.com/CASTagScience/posts/1812875135473941>

2 likes and 1 share

CAST, July 13, 2018

<https://www.facebook.com/CASTagScience/posts/1815690338525754>

Dairy Producer.ca, July 11, 2018

<https://www.facebook.com/dairyproducer/posts/636913650011386>

NCState University SPIA, July 9, 2018

<https://www.facebook.com/NCStateUniversitySPIA/photos/a.1608796486081560.1073741828.1598413097119899/1855834278044445/?type=3>

Small Farms, July 11, 2018

<https://www.facebook.com/SmallFarmsCook/posts/1580068902092553>

Twitter–

AASV News Headline @aasvnews, July 9, 2018

<https://twitter.com/aasvnews/status/1016344437688070145>

1 like

AGree @AGreeAgPolicy, July 10, 2018

<https://twitter.com/AGreeAgPolicy/status/1016687235385741312>

1 like and 1 retweet

AgriPulse @agripulse, July 11, 2018

<https://twitter.com/agripulse/status/1017009748250685441>

3 retweets

A.N. Rao @ANRao2, July 11, 2018

<https://twitter.com/ANRao2/status/1016996970139799552>

1 like

ASPB @ASPB, July 9, 2018

<https://twitter.com/ASPB/status/1016403142999773184>

2 likes

This report last updated 7/9/2020.

B4FA @B4FA, July 11, 2018

<https://twitter.com/B4FA/status/1017029676714381312>

1 like

BiosafetySouthAfrica @Biosafety_SA, July 11, 2018

https://twitter.com/Biosafety_SA/status/1016978825576681473

1 retweet and 1 like

Biotech Mag @BioTechMagTop, July 16, 2018

<https://twitter.com/BioTechMagTop/status/1018877188861554689>

1 like

Bonnie McCarvel @MidAmericaCrop, July 12, 2018

<https://twitter.com/MidAmericaCrop/status/1017398425262882817>

1 like

CAST @CASTagScience, July 9, 2018

<https://twitter.com/CASTagScience/status/1016253124070162432>

2 likes

CAST @CASTagScience, July 9, 2018

<https://twitter.com/CASTagScience/status/1016230479513743360>

2 retweet and 1 like

CAST @CASTagScience, July 7, 2018

<https://twitter.com/CASTagScience/status/1015581199064895489>

CAST @CASTagScience, July 5, 2018

<https://twitter.com/CASTagScience/status/1014964992653905926>

1 retweet

CAST @CASTagScience, July 2, 2018

<https://twitter.com/CASTagScience/status/1013890066303905794>

CAST @CASTagScience, June 29, 2018

<https://twitter.com/CASTagScience/status/1012710979434577920>

CAST @CASTagScience, June 12, 2018

<https://twitter.com/CASTagScience/status/1017532805348118530>

2 retweets and 2 likes

CAST @CASTagScience, June 13, 2018

<https://twitter.com/CASTagScience/status/1017914072463900673>

2 retweets and 2 likes

CAST @CASTagScience, July 21, 2018

<https://twitter.com/CASTagScience/status/1020828270802161665>

3 retweets and 4 likes

Cornell in DC @CornellinDC, July 9, 2018

<https://twitter.com/CornellinDC/status/1016404904619970560>

8 retweets and 22 likes

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Crop Production Services MS, @ServicesCrop, July 11, 2018

<https://twitter.com/ServicesCrop/status/1016971632466788352>

1 like

C.S. Prakash @AgBioWorld, June 26, 2018

<https://twitter.com/AgBioWorld/status/1011688340079431681>

5 retweets and 1 like

DairyBuisness @dairybusiness, July 9, 2018

<https://twitter.com/dairybusiness/status/1016363687408558080>

1 like

Dairy Producer.ca @dairyproducerca, July 11, 2018

<https://twitter.com/dairyproducerca/status/1017064417127751682>

2 likes

Dennis Eriksson @cultivision, June 25, 2018

<https://twitter.com/cultivision/status/1011344153530204163>

2 likes

Genetic Engineering & Society Center @GESCenterNCSU, July 9, 2018

<https://twitter.com/GESCenterNCSU/status/1016423472153718786>

2 comments, 8 likes, and 4 retweets

Genetic Engineering & Society Center @GESCenterNCSU, July 9, 2018

<https://twitter.com/GESCenterNCSU/status/1016461157023014912>

1 comment, 2 retweets, and 1 like

Genetic Engineering & Society Center @GESCenterNCSU, July 10, 2018

<https://twitter.com/GESCenterNCSU/status/1016663745957974016>

1 like

Keith Edmisten @NCcropbiotech, July 11, 2018

<https://twitter.com/NCcropbiotech/status/1017148372371804160>

1 like

Kristyn Nanlal Khetia @Kaenkay, July 13, 2018

<https://twitter.com/Kaenkay/status/1017763635572207617>

1 like

Leighona Bernstein @LeighhonaB, July 9, 2018

<https://twitter.com/LeighonaB/status/1016352724223430657>

1 like

Magdalen Lindeberg @MagdalenLindebe, July 11, 2018

<https://twitter.com/MagdalenLindebe/status/1017126101339041793>

3 retweet and 5 likes

Marco Winters @marco_winters, July 10, 2018

https://twitter.com/marco_winters/status/1016610135211421697

1 retweet and 2 likes

Nat Wheat Foundation @NationalWheat, July 11, 2018

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<https://twitter.com/NationalWheat/status/1017107564541161477>

NCStateSPIA @NCStateSPIA, July 9, 2018

<https://twitter.com/NCStateSPIA/status/1016443091933376514>

5 likes

Osman Mewett @OsmanCropLife, July 16, 2018

<https://twitter.com/OsmanCropLife/status/1018997599527813120>

5 retweets and 6 likes

Rhona Applebaum @RhonaA_PhD, July 9, 2018

https://twitter.com/RhonaA_PhD/status/1016299637706252288

1 retweet and 1 like

Ron Hays @Ron_on_ROM, July 9, 2018

https://twitter.com/Ron_on_ROM/status/1016356332067176449

1 retweet and 1 like

Ria de Grassi @CAFarmersDtr, July 7, 2018

<https://twitter.com/CAFarmersDtr/status/1015583514794704896>

1 like

Stephen Baenziger @Huskerwheat, July 9, 2018

<https://twitter.com/Huskerwheat/status/1016273024209883138>

1 retweet and 1 like

Stephen Baenziger @Huskerwheat, July 21, 2018

<https://twitter.com/Huskerwheat/status/1020877888676139008>

3 likes

Stephen Mellor @sp_mellor, July 16, 2018

https://twitter.com/sp_mellor/status/1018790633341947904

Tom Oswald @notilltom, July 1, 2018

<https://twitter.com/notilltom/status/1013589717013745664>

1 like

LinkedIn –

Aaron Hummel, July 14, 2018

<https://www.linkedin.com/feed/update/urn:li:activity:6423560691457761280>

5 likes

CAST, July 10, 2018

<https://www.linkedin.com/feed/update/urn:li:activity:6422507318268739584/>

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<https://www.linkedin.com/feed/update/urn:li:activity:6422018914976362496/>

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<https://www.linkedin.com/feed/update/urn:li:activity:6417103250465656832>

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<https://www.linkedin.com/feed/update/urn:li:activity:6413510356630667264>

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<https://www.linkedin.com/feed/update/urn:li:activity:6423298566369931264>

3 likes and 2 shares

CAST, June 15, 2018

<https://www.linkedin.com/feed/update/urn:li:activity:6424042208025993216>

David Songstad, June 14, 2018

<https://www.linkedin.com/feed/update/urn:li:activity:6423550704190783488>

6 likes

Petra Jorasch, June, 14, 2018

<https://www.linkedin.com/feed/update/urn:li:activity:6383589675118006272>

Blogger –

Genome Editing in Agriculture: Publication Release and Recent Research, June 10, 2018

<http://cast-science.blogspot.com/2018/07/genome-editing-in-agriculture.html>

Gene Editing--Touching All Avenues of Ag, June 15, 2018

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