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Agri Innovation Post

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This month many of the reports included in our newsletter focus on drought tolerance and water use efficiency. Water paucity as well as poor quality of water are rapidly becoming harbinger of severe impact of climate change. Agriculture is one of the contributors to greenhouse gas emissions and rising temperatures but is most severely impacted with major yield losses in the short-term and deteriorating soil and water resources in the long-term. Adoption of climate smart agriculture with regenerative agriculture practices as well as crops with climate resilience traits has become critical to maintain food productivity via sustainable agriculture. Sourcing traits from plants that are naturally adapted to restrictive conditions with low water and poor soil is being taken up in a big way. These include pineapple, orchids and agave which can grow in hot, dry conditions. Scientists are also exploring a mechanism for voluntarily activating the plant hormone signalling of abscisic acid (ABA), which participates in plant growth and development processes, as well as in the adaptive response to stress. Development of wheat with longer roots, drought tolerant soybean and tomato using different metabolic pathways are steps in the right direction. Scientists are also developing plants that can withstand alkaline soils that are developing due to improper soil drainage and water paucity. Commercial cultivation of drought tolerant HB4 wheat as well as field trials of heat tolerant gene edited wheat is very encouraging and points to better consumer awareness acceptance for different technologies that can help mitigate the adverse impact of climate change on agriculture and help preserve resources. We hope you find the newsletter informative and useful.



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Alliance for Agri Innovation

A special interest group of Federation of Seed Industry of India

News from India and Around the World

[Here's how gene editing could save the beloved Cavendish banana from extinction](#)

US-based Elo Life Systems, a biotech company targeting food sustainability, is tapping into gene-editing to save Cavendish bananas from a fungus that could potentially wipe out the species. On a Dole banana plantation in Central America, a field trial is being set up to test Cavendish bananas that

have been gene-edited in an attempt to help them survive the fungus.

Developing foods with cutting-edge technology "Food Tech"

<https://go2senkyo.com/seijika/136110/posts/583714>

Foodtech is attracting attention as a means of solving the problem of food shortages accompanying the rapid increase in the world's population. According to estimates released by the United Nations in November last year, the world's population exceeded 8 billion as of the same day. The population, which was about 2.5 billion in 1950, continues to grow, and the United Nations predicts that it will reach 10 billion by 2058. By incorporating cutting-edge technology into food production, processing, distribution, and consumption, we can create new foods that have never existed before, and provide foods that take into account the symptoms of allergies and other health conditions of each individual. Food Tech" (Food Technology).

U.S. seed magazine spotlights plant breeding innovations

<https://seedworld.com/with-over-8-billion-mouths-to-feed-its-time-to-innovate/>

Plant breeders across all seed sectors are getting innovative and creative to feed the globe. Whether or not the world's population is growing exponentially or growing at a slower rate than projected, it's safe to say one thing's for certain: as of Nov. 15, 2022, there are over 8 billion mouths to feed on the planet. For most people, that's a near impossible number to picture. But for the seed sector who's been hearing about the threat of 9 billion people globally by 2050, it's just another reality check and reminder that our jobs come with a heavy burden.

Great-tasting heirloom wine grape varieties can survive climate change with CRISPR gene-editing

<https://www.cbc.ca/news/canada/windsor/wine-future-hybrids-crispr-1.6766089>

When it comes to surviving a changing climate, vinifera varieties have limited options. Since we plant them clonally to preserve the variety, they don't have a chance to adapt or evolve. Instead, they acclimate as best they can. When temperatures drop, the vine braces itself for winter, building up cold tolerance and going dormant. In recent years, many vineyards have had to adopt new strategies and technologies, like geotextile (permeable) blankets to cover vines and wind machines to keep air moving, said Debbie Zimmerman, chief executive officer of Grape Growers Ontario.

Biotech Potatoes and Food Security – Dr. David Douches

<https://podcasts.apple.com/us/podcast/biotech-potatoes-and-food-security-dr-david-douches/id1006329802?i=1000604724520>

The potato is a world food staple, yet it is constantly threatened by fungal and viral pathogens in all of its growing regions. Farmers combat these problems with chemistry, which cuts farmers profits and has potential consequences for applicators and the environment. Dr. David Douches from Michigan State University discusses the USAID project that installed a cassette of disease resistance genes from wild potato species in the cultivated potato. The result is a potato that can survive better in the Developing World, helping to ensure food security.

All good with HB4, but in Brazil they also approved their own drought-tolerant soybean, and it's not transgenic

<https://bichosdecampo.com/todo-bien-con-el-hb4-pero-en-brasil-tambien-aprobaron-su-propia-soja-tolerante-a-la-sequia-y-no-es-transgenica/>

The CTNBio also approved in the last few hours a soybean developed by Embrapa (an organization similar to INTA in the neighboring country) to have greater tolerance to drought. Unlike a transgenic, this soybean was achieved based on the CRISPR (Clustered Regularly Interspaced Short Palindromic Repeats) gene editing technique. For this reason, it was considered a “conventional” soybean by the Brazilian regulatory authorities.

IAR, AATF to boost Nigeria’s maize production by 43 %

<https://guardian.ng/features/agro-care/iar-aatf-to-boost-nigerias-maize-production-by-43/>

The Institute of Agricultural Research (IAR), Ahmadu Bello University (ABU), Zaria, Kaduna State, in conjunction with the African Agricultural Technology Foundation (AATF) has assured that Nigeria’s food would soon be strengthened with the production of hybrid crop – TELA maize, which would boost farmers yield by 43 per cent.

Exercising technological sovereignty: the case of HB4 wheat

<https://revistamovimiento.com/politicas/ejerciendo-la-soberania-tecnologica-el-caso-del-trigo-hb4/>

At the beginning of March 2023, the Brazilian government authorized the planting, production and commercialization of wheat with HB4 technology, which put an end –or rather, the beginning point– to a feat of Argentine plant biotechnological development. For those who are not specialists in the matter, told synthetically, the story begins in 2004 when a group of researchers from the National University of the Coast (UNL) identified a sunflower gene that confers resistance to drought.

APHIS Issues Regulatory Status Review Responses: Donald Danforth Center Teff and Moolec Science

Limited Safflower

https://www.aphis.usda.gov/aphis/newsroom/stakeholder-info/sa_by_date/sa-2023/aphis-rsr-ddct-msls

The U.S. Department of Agriculture's (USDA) Animal and Plant Health Inspection Service (APHIS) recently reviewed a teff plant and a safflower plant that were modified using genetic engineering. The teff plant from the Donald Danforth Center was modified to produce shorter plants and reduce the likelihood of lodging (stem buckling). The safflower plant from Moolec Science Limited was modified to produce gamma-linolenic acid, an essential omega-6 fatty acid, in seeds to alter their nutritional value. In both cases, APHIS found these plants unlikely to pose an increased plant pest risk compared to other cultivated teff and safflower plants.

Why the European Union needs to grow genetically-engineered crops

<https://geneticliteracyproject.org/2023/04/04/why-the-european-union-needs-to-grow-genetically-engineered-crops/>

The United States, Argentina, Brazil, Canada, Israel, Japan, and India are among the growing number of countries that have deregulated or have decided not to regulate CRISPR gene-edited plants and other new plant breeding techniques (NPBTs). That's paving the way for farmers to introduce a host of more sustainable crops that can limit disease, reduce the use of pesticides and fertilizers, and adapt to drought and flooding. Scientists are also finding ways to increase the yield and grow more nutritious crops. In late March, England decided to join other countries in adopting NPBTs when Parliament approved gene-editing for plants and animals. The precision breeding legislation does not apply to Scotland, Wales and Northern Ireland whose restrictions on gene-editing remain as severe as those in the EU — regulations that will hinder the international competitiveness of its farmers. Although the European political establishment is stuck in the past, farmers and scientists are not. Many are clamoring for these new technologies.

[Agriculture and climate change: Taking the best of all farming systems could tip the carbon scale in the right direction](#)

Agriculture contributes a significant portion of the world's climate-changing greenhouse gases. To reduce the impact of agriculture on climate, the carbon sink has to be increased as well as new crop varieties developed that can withstand severe abiotic and biotic stresses.

[Crops that tolerate droughts and climate change? Here's how cactus genes could help](#)

This past summer, a widespread drought across the United States lowered crop yields by as much as

one-third as corn, wheat, barley and other plants suffered from too much heat and too little water. It's a scenario that will likely become more common as climate change makes much of the world a hotter, drier place.

USDA Clears Danforth Center's Genome Edited Teff

<https://www.danforthcenter.org/news/usda-clears-danforth-centers-genome-edited-teff/>

A pre-market regulatory status review conducted by the United States Department of Agriculture (USDA) Animal and Plant Health Inspection Service has concluded that teff modified by genome editing to have a semi-dwarf stature is not subject to biotechnology regulation under USDA's SECURE Rule.

Japan Gives Nod to Genome-edited Waxy Maize

The Ministry of Health, Labour, and Welfare and the Ministry of Agriculture, Forestry, and Fisheries in Japan gave their green light to a high-starch maize variety on March 20, 2023. This is the fourth genome-edited food product that Japan did not subject to regulations for genetically engineered (GE) food, feed, and biodiversity.

New Research

Global Plant Council amplifies study on virus-resistant crops

<https://globalplantcouncil.org/copying-nature-to-resist-viruses/> <https://onlinelibrary.wiley.com/doi/10.1111/pbi.14003>

One of the impacts of climate change is the proliferation of viruses on cultivated plants. To reduce the use of pesticides and promote the deployment of agroecological practices, one strategy is to increase the natural resistance of plants to viruses. Promising results, using genome editing to mimic natural selection. For thousands of years, crops have been shaped by domestication processes. Farmers cross-breed and select new varieties, adapted to constantly changing environments. Although efficient, this process is time consuming. Moreover, the desired trait must be present somewhere within the diversity of the species to be improved.

Genome Editing Plant Cells with Atmospheric Pressure Plasma

A team of researchers from the RIKEN Center for Sustainable Resource Science and partners attempted genome editing using the atmospheric-pressure plasma as protein introduction technique. Transgenic reporter plants were used as an experimental system to assess genome editing. The

transgenic plants carried the reporter genes *L-(l-SceI)-UC* and *sGFP-waxy-HPT*. The success of genome editing was measured through the chemiluminescent signal from the re-functionalization of the luciferase gene that proceeded after genome editing.

[CRISPR-Cas9 Possible 'Savior' for Rice Crops](#)

The review highlights that while rice is one of the most consumed cereals worldwide and feeds about three billion people, climate-induced abiotic and biotic stresses have affected the production and quality of rice crops. Dr. Antonio Costa de Oliveira from the Federal University of Pelotas, Brazil, and a team of fellow scientists found that the CRISPR-Cas tool was efficient in gene editing in studies related to yield, tolerance to biotic and abiotic stresses, and rice grain quality.

[Scientists Unlock Key to Drought-Resistant Wheat with Longer Roots](#)

The study published in the journal *Nature Communications* provides novel tools to modify wheat root architecture to help the plants withstand low water conditions, said Gilad Gabay, a postdoctoral researcher in the Department of Plant Sciences at UC Davis and the paper's first author. Little has been known about the genes affecting the root structure of wheat. The discovery of the OPRIII gene family and that different copies of these genes affect root length is a significant step, said Distinguished Professor Jorge Dubcovsky, the project leader in the lab where Gabay works.

Spanish scientists develop method to activate plants' drought response

<https://www.lavanguardia.com/vida/20230313/8821580/patentan-metodo-activar-resistencia-sequia-plantas.html>

Scientists from the Higher Council for Scientific Research (CSIC) and the Polytechnic University of Valencia (UPV) have developed and patented a drug to activate the resistance of crop plants to drought. This is a mechanism for voluntarily activating the plant hormone signaling called abscisic acid, which participates in plant growth and development processes, as well as in the adaptive response to stress, the results of which have been published in *Science Advances*.

Vietnamese scientists use gene editing to enhance tomato's taste, nutrition

<https://vnexpress.net/viet-nam-tao-ra-giong-ca-chua-ham-luong-axit-amin-tang-gap-2-lan-4579392.html>

Scientists have successfully created a gene-edited tomato using CRISPR/Cas9 technology that has twice the sugar and amino acid content. The gene editing system using CRISPR/Cas9 technology has been successfully applied by scientists at the Institute of Biotechnology (IBT), Vietnam Academy of

Science and Technology on domestic tomato varieties. The transgenic tomato lines had 13–45% increase in sugar content and 62–132% increase in amino acid content compared to unmodified control plants. These are the ingredients that help tomatoes have a delicious taste and improve their nutritional value.

[Preventing Agrobacterium Overgrowth in Plant Transformation](#)

Transgenic Research released a review article containing the reasons and preventive methods for the overgrowth of *Agrobacterium tumefaciens* during plant transformation. *Agrobacterium tumefaciens*-mediated plant transformation has been extensively used to investigate gene function and in developing genetically modified plants. However, the transformation process may entail some issues, such as the overgrowth of *Agrobacterium* that occasionally happens after the co-cultivation phase of the explant.

[Making moths avoid apples? Gene-edited bio-pesticides in development](#)

<https://www.goodfruit.com/genetic-research-rearing-moths-that-dont-like-them-apples/>

A U.S. Department of Agriculture researcher wants to use genetics to control codling moth. William Walker of the Agricultural Research Service laboratory in Wapato, Washington, has three projects underway that aim to use genetic manipulation to thwart one of the Northwest apple industry's most loathed pests. One of Walker's experiments uses CRISPR gene editing to alter a female moth's sense of "smell," so she does not like apples as a place to lay eggs. Another aims to create a biopesticide that interrupts the genetic code translation and shuts down a moth larva's ability to manufacture a protein critical for survival.

[Startup Develops Better-tasting Yellow Peas Using CRISPR](#)

Israeli-based Plantae Bioscience announced their success in using CRISPR to remove 99% of bitter-tasting compounds in yellow peas. This breakthrough is expected to pave the way towards better-tasting yellow peas. The researchers are working on several innovations, including gene-edited fruits and vegetables with boosted levels of plant nutrients. The CRISPR yellow pea is their first project, which is an important contribution to the world of plant proteins.

[Gene Editing Technology to Fight Corn Disease](#)

Corteva Agriscience announced on March 10, 2023, that their game-changing gene editing technology that will give additional protection to elite corn hybrids has advanced through their R&D pipeline. The proprietary technology has multiple disease-resistant native traits packaged into a

single location in the gene to better address the most devastating North American corn diseases.

Growing Crops on Mars Possible with Gene Editing

Mars was found to have the elements to help plants grow on it. The planet has water, regolith, light, and carbon dioxide. While its regolith, which is the planet's rocky surface above the bedrock, is the more challenging factor, simulated studies still found that it can support plant growth. Thus, researchers from Arkansas in the United States proposed to plant rice on the Martian surface.

Improved Editing through CRISPR-targeted Transposable Element Insertion

The present tools used to insert DNA in specific sites in the plant genome are low-frequency and error-prone. Transposable elements, which are considered genome 'parasites' have evolved to insert their DNA effectively into genomes. They choose the insertion site based on preferences of chromatic contexts, which vary among TE classes. Thus, took advantage of the TE's natural ability to insert the genome precisely and came up with a genome editing tool that controls TE insertion.

They generate soybean that mitigates infestation by white fly and drought tolerant

<https://conexion.cinvestav.mx/Publicaciones/generan-soya-que-160mitiga-infestaci243n-por-mosquita-blanca-y-tolerante-a-sequ237a>

With the aim of improving their yield and quality, the scientific group led by Beatriz Xoconostle Cázares, a researcher at Cinvestav's Department of Biotechnology and Bioengineering, developed some soybean varieties capable of inhibiting the action of its main pest: the whitefly, in addition to exhibit greater tolerance to drought. Using a precision technological tool called gene editing, they used molecular scissors and made discrete changes to the genetic material of soybeans, with identical results to conventional mutation processes, but in less time and more precisely, the researcher explained.

International Potato Center unveils late blight-resistant potato for Kenya and Nigeria

<https://farmersreviewafrica.com/international-potato-center-unveils-late-blight-resistant-potato-for-kenya-and-nigeria/>

The International Potato Center (CIP) is working on providing market access to genetically engineered potato varieties with complete resistance to late blight disease for farmers in Kenya and Nigeria. The program run in conjunction with Michigan State University (MSU) has held confined lab and field trials in Kenya, Nigeria, and Uganda with the cultivar showing absolute resistance to late blight- not tolerance- minimizing the risk of the pathogen's adaptation.

[Read VKM's description of the risk assessment and see the report: Genetically modified rapeseed oil as an ingredient in fish feed](#)

There is also no indication that rapeseed oil poses a risk of negative effects on the environment, compared to conventional feed. That is the conclusion of a risk assessment that VKM has carried out on behalf of the Norwegian Food Safety Authority. The background is that the Norwegian Food Safety Authority has received an application to approve rapeseed oil for use as an ingredient in fish feed.

Israeli Scientists Develop Drought-Resistant Tomatoes

<https://themedialine.org/life-lines/israeli-scientists-develop-drought-resistant-tomatoes-in-response-to-climate-change/>

Israeli researchers have developed a new variety of tomato that is more resistant to drought conditions and could help farmers cope with the destructive impact of climate change. An in-depth genetic analysis led by the Hebrew University of Jerusalem identified interactions between two areas of the tomato's genome that lead to increased yield and resistance to dry conditions. The resulting new tomato variety can cope with extreme weather conditions. The study's findings were published on Monday in the peer-reviewed Proceedings of the National Academy of Sciences of the United States of America (PNAS) journal.

[New Gene Discovery to Help Develop Crops with Better Alkaline Tolerance](#)

Scientists in China have identified a gene involved in alkaline tolerance in crops that may help improve yields in sodic environments through genetic engineering. The study, led by Prof. Xie Qi's team from the Institute of Genetics and Developmental Biology of the Chinese Academy of Sciences, in collaboration with seven other institutions, has been published in *Science*.

[2Blades and Collaborators Release the Annotated Genome Sequence of the Soybean Rust Pathogen](#)

2Blades Foundation and a group of international collaborators have published the annotated genome sequence of *Phakopsora pachyrhizi*, the causal agent of Asian soybean rust and one of the most damaging plant pathogens of the past century. The findings are published in *Nature Communications*.



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