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INTERNATIONAL NEWS

Friendly™ Fall Armyworm Reduces FAW Populations on Commercial Bt Corn Farms in Brazil

Oxitec Ltd. has announced the successful conclusion of the first farm-scale pilot deployments of its Friendly™ fall armyworm on commercial [Bt](#) cornfields in [Brazil](#). The Brazilian government's regulatory authorities approved the Friendly™ fall armyworm technology in [2021](#).

The pilot deployments were conducted on thousands of acres of commercial farmland in São Paulo State, a key corn-growing region in Brazil, during the first annual corn crop season of 2021-2022. Oxitec announced that the deployments have successfully validated the performance of the Friendly™ fall armyworm solution in an open field, farm settings.

For more details, read the press release from [Oxitec](#).

The Friendly™ fall armyworm can reduce populations of fall armyworm (FAW) and provide long-term protection of the effectiveness of biotech crops against this devastating crop pest.

A [peer-reviewed study](#) published in *BMC Biotechnology* shows that Oxitec's Friendly™ Fall Armyworm technology describes early research conducted in the development of Oxitec's Friendly™ fall armyworm, including the results of in-depth mathematical modeling showing that when male moths are deployed, the development of biotech corn-resistant FAW is significantly delayed, leading to sustained FAW management over a much longer period.

Speed Breeding to Help Preserve Australia's Mango and Macadamia Industries

To help growers better understand the function of different [genes](#) in mango and macadamia [trees](#), Queensland University of Technology (QUT) researchers are developing new tools for testing gene function to speed up the development of elite cultivars for both tree industries to respond quickly to challenges like pests, diseases, and [climate change](#).

Mango and macadamia account for half of Australia's horticultural industry, but both have not undergone extensive molecular breeding programs to produce elite cultivars to make them more resilient to pests, diseases, and climate change impacts. Dr. Stephanie Kerr and her team intend to address this by developing new techniques that use nanoparticles to influence the gene expression for flowering and possibly shorten the plants' juvenile period.

Learn more from the news release by [QUT](#).

The first technique will use 'nanotubes' designed to be small enough to enter the cells of the plant to introduce molecules that turn off the expression of genes that stop the plant from flowering. The second technique is 'micro wounding' or micro dermal needling to create tiny holes in the surface of the leaf to make it more susceptible to *Agrobacterium* infection and deliver molecules that turn on gene expression for earlier flowering.

Both techniques were proven successful in other tree crops, in which the juvenile periods were reduced from 7-20 years into just several weeks or months. If Kerr and her team will be successful with the new techniques, mango and macadamia cultivars that can cope with pests, diseases, and climate change can be developed in shorter periods of time.

Agri-Biotech News

Australia's OGTR Receives Application for Commercial Release of GM Indian Mustard

Australia's Office of the Gene Technology Regulator (OGTR) has received license application DIR 190 from BASF Australia for commercial cultivation of [genetically modified](#) (GM) Indian mustard line RF3 modified for [herbicide tolerance](#).

GM Indian mustard RF3 has been produced by [conventional breeding](#) of non-GM Indian mustard with [GM canola](#) containing the RF3 modification. The GM Indian mustard contains [genes](#) for herbicide tolerance and for male fertility restoration.

For more information, including the notice of the application, questions and answers, and a summary of the license application, visit the [DIR 190 page](#) on the [OGTR website](#).

BASF is seeking approval to commercially grow the GM Indian mustard [Australia](#)-wide, in all Indian mustard growing areas. The GM Indian mustard and its products would enter general commerce, including use in human food and animal feed. The Gene Regulator is preparing the Risk Assessment and Risk Management Plan for the application to be released for public comment and advice from experts, agencies, and authorities in July 2022.

Researchers Discover Imbalanced Expression of Genes Help Improve Wheat Yield

Researchers from Kansas State University (K-State) have published the results of their work that characterized numerous [wheat genes](#) duplicated thousands of years ago to understand how they control the crop's yield and other desirable traits.

Led by Eduard Akhunov, wheat geneticist and director of K-State's Wheat Genetic Resources Center, said his team's research may lead to greater opportunities for breeders to perform “targeted breeding” that can increase grain size and number – ultimately increasing yields. They studied the role of gene copies available from each of the respective [genomes](#) in polyploid crops, those that contain more than two sets of chromosomes, in shaping main agronomic traits. Bread wheat, he added, is polyploid, formed nearly 10,000 years ago from merging the genomes of two wild ancestors: tetraploid wild emmer wheat (which has a genome

formula known as AB) and diploid goatgrass (with genome formula D). As a result, most genes in wheat exist in three copies, one from each of the A, B, and D genomes said Akhunov.

In the current study, K-State researchers tested combinations of the gene copies to see the impact they would have on wheat's growth and productivity. The team found that there is a relatively small subset of genes where copies from different wheat genomes are expressed at different levels, referred to as an imbalanced expression of genes. This turned out to have a positive effect on wheat, in many cases increasing grain size, weight, and number. The K-State study suggests that over many years, breeders have selected combinations of imbalanced genes that positively impacted yield in diverse climatic environments.

For more details, read the article in [K-State Research and Extension](#).

Research Team Led by NTU Singapore Produce Oil from Microalgae to Replace Palm Oil in Food Production

A team of scientists led by Nanyang Technological University, Singapore (NTU Singapore) has

developed a method to effectively produce and extract plant-based oils from common microalgae,

using a newly discovered method that could serve as a healthier and greener alternative to palm oil.

Palm oil is the world's most popular vegetable oil, used in around half of all consumer products. However, the rapid expansion of oil palm plantations has been blamed for massive deforestation in several countries, destroying the habitat of endangered native wildlife.

The NTU team added pyruvic acid to a solution with the algae *Chromochloris zofingiensis* and exposed it to ultraviolet light to stimulate photosynthesis. The

For more details, read the media release from [NTU Singapore](#).

team developed a cost-cutting innovation to replace the microalgae culture medium with fermented soybean residues while improving the yield of microalgae biomass. After 14 days, the microalgae was washed, dried, and treated with methanol to break down the bonds between the oils and algae protein, and the oil was extracted. This innovation could be a possible alternative to the cultivation of palm trees for oil.

The NTU team also developed a process to produce pyruvic acid, the key reaction ingredient needed to cultivate microalgae oil.

UK Prepares for Field Trials of GM and Gene-Edited Barley

Crop Science Centre, an alliance between the University of Cambridge and the National Institute of Agricultural Botany, will conduct a field trial of [genetically modified](#) (GM) and [gene-edited](#) barley with the aim of reducing dependency on synthetic fertilizers to promote improved soil health, and sustainable and equitable means of food production.

The planting is set for April 2022 and will help scientists evaluate whether improving the interaction between crops and naturally occurring soil fungi can help the plants absorb water with [nitrogen](#) and phosphorus in the soil, as both elements are often provided to plants through synthetic fertilizers. The evaluation will involve a GM barley modified to boost expression levels of the NSP2 [gene](#) to enhance its existing capacity to interact with mycorrhizal fungi. It will also involve gene-edited barley varieties that can suppress their interaction with arbuscular mycorrhizal fungi to help scientists to assess the full

Read the news release from the [Crop Science Centre](#) to learn more.

spectrum of the interactions and quantify how the microbes support plant development. The field trial will assess barley production under high and low phosphate conditions, as well as investigate additional potential crop protection against pests and diseases as a result of the relationship between the plant and mycorrhizal fungi.

The scientists emphasized that biotechnology can be a valuable tool in providing options available to farmers around the world. In this case, developing barley that can potentially reduce the dependency on synthetic fertilizers can help [farmers](#) in developing countries reduce their input costs and increase their income which can lead to a boost in food production. On the other hand, reducing the use of synthetic fertilizers in high- and middle-income countries lowers environmental pollution, helps preserve [biodiversity](#), and reduces greenhouse gas emissions.

Health-Biotech News

Potato Genome Decoded by German Research Team

For the first time, researchers from the Ludwig Maximilian University in Munich and the Max Planck Institute for Plant Breeding Research in

Cologne have completely decoded the highly complex [genome](#) of the [potato](#).

The researchers, led by geneticist Korbinian Schneeberger from the Max Planck Institute for Plant Breeding Research have now succeeded in assembling the first complete genome of the potato, a breakthrough that paves the way for breeding new and robust varieties. "Potatoes are increasingly becoming part of basic nutrition around the world," says Schneeberger. He added that even in Asian countries like China where rice is the traditional staple, the potato is gaining ground. This study can now support genome-based breeding of new potato varieties that are more productive and resilient to [climate change](#), which has a huge impact on global food security for decades to come.

The potato has low diversity and anyone who buys potatoes today is very likely to go home with a variety that was around more than 100 years ago. Low diversity has always made potato plants

For more details, read the article on the [Max Planck Institute for Plant Breeding Research website](#).

UC Davis Team Develops GM Lettuce to Protect Astronauts' Bones in Long Spaceflights

Researchers at the University of California, Davis (UC Davis) have developed a [genetically modified](#) (GM) lettuce that produces a drug which protects against bone density loss in microgravity. This breakthrough can help astronauts grow and eat nutritious plants than help them prevent diseases caused by long spaceflights.

The human bones constantly undergo a balance of growth and resorption to respond to injury and exercise. This balance is disturbed under microgravity, leaning towards more resorption. Thus, astronauts lose bone mass. The cure for such is regular injections of parathyroid hormone (PTH).

Read more from [UC Davis](#).

GM Maize 'Ruifeng 125' Exhibits Excellent Protection Against Corn Borers

Zhejiang University developed Ruifeng 125, an [insect resistant genetically modified](#) (GM) [maize](#).

susceptible to diseases, as evident during the Irish famine in the 1840s. Likewise, reconstructing the potato genome was a far greater technical challenge than the human genome because the potato inherits two copies of each chromosome from each parent. Four copies of each chromosome mean four copies of each gene, which makes creating new varieties with the desired combination of individual traits very difficult and time-consuming.

Schneeberger and colleague Hequan Sun and other employees circumvented this problem by not using the DNA taken from the leaf tissue as usual but analyzing the genomes of individual pollen cells. Unlike other cells, each pollen cell contains only two copies of each chromosome, making it easier to reconstruct the genome. With the new information, researchers can now easily identify gene variants that are responsible for desired traits.

UC Davis graduate student, Kevin Yates, together with his professors, developed a GM lettuce that produces a fusion protein combining PTH with part of a human antibody protein. The fusion protein is engineered to be unchanging in the bloodstream. Being able to plant and extract the drug will be beneficial to astronauts in long spaceflights to save weight and get a fresh source of drugs. Conventional medicines usually have a short shelf life and thus astronauts would need ways to replenish their supplies during long spaceflights.

The research team is analyzing the amount of drugs that GM lettuce can produce, which leaves have the most amount of PTH, and the optimal time to harvest the leaves.

Field experiments conducted for over five years showed significant results.

Ruifeng 125 can produce an efficient insecticidal protein to kill lepidopteran insects such as corn borers and cotton bollworms. Studies have shown that Ruifeng 125 can provide corn borer control to as high as 96%. It can also decrease the number of damaged kernels which are prone to toxin-producing microbes. Furthermore, maize yield can increase by 6 to 10% compared to conventional maize. “This number may not seem impressive, but the average yield per mu can rise by over 50 kilograms. With 600

Read the news article from [Zhejiang University](#).

Research Highlights

Bt Maize Exhibits Protection Against Stem Borers in Uganda

Researchers from National Crops Resources Research Institute, Uganda, conducted a study to analyze the performance of [Bt maize MON810](#) in controlling maize stem borers. The results are published in *Crop Protection journal*.

African stem borer (*Busseola fusca*) and the spotted stem borer (*Chilo partellus*) are among the major insect pests of [maize](#) in Uganda. To evaluate the [insect resistance](#) trait of Bt maize expressing *CryIAb*, the research team applied artificial infestation to 14 non-commercialized hybrids, including seven pairs of Bt and non-Bt. Read the complete findings in [Crop Protection](#).

Study Confirms Food and Feed Safety of DHA Canola

Oil from bioengineered [canola](#) has been found to be safe to consume in human foods, nutraceuticals, and [animal feeds](#). Results of the study are published in *Frontiers in Nutrition*.

The bioengineered canola ([NS-B50027-4](#)) is a plant-based source for omega-3 long-chain polyunsaturated fatty acids, with a high level of docosahexaenoic acid (DHA), thus it is referred to as [DHA canola](#). The said nutrients were originally obtained from marine sources but the increasing demand for such has led to overfishing. Nuseed developed DHA canola, which can serve as biofactories of the nutrients. Just one to Know more from [Frontiers in Nutrition](#) and [Nuseed](#).

million mu nationwide, the increased yield will add up to 30 billion kilograms,” said Prof. Shen Zhicheng, leader of the research team.

On January 21, 2020, Ruifeng 125 was one of the 192 GM plant varieties that were granted safety certificates by China’s Ministry of Agriculture and Rural Affairs. It was the first time that [China](#) issued safety certificates to locally developed GM crops since 2010.

hybrids, three non-Bt commercial hybrids, and a conventional stem borer resistant check from 2014-2016. Results showed stem borer damage was significantly reduced in Bt hybrids than the others. Grain yield was also observed to be higher by 29.4 to 80.5% in Bt hybrids compared to the non-Bt hybrids.

Based on the results, Bt maize has built-in protection against leaf damage and can impede the entry of stem borers on the stems of maize plants, leading to higher yields.

two hectares of DHA canola could provide about the same amount of DHA from 10,000 kg fish.

The study showed that aside from the changes in the fatty acid profile, the DHA canola is compositionally equivalent to the conventional canola varieties. Furthermore, the nutritional value and safety of DHA canola were confirmed in fish feeding studies. This has the potential to impact the aquaculture industry which demands reliable sources of omega-3 oil for the health and welfare of farmed fish.

Salt-tolerance Trait from Arabidopsis Relative Found Effective for Cotton

Scientists found evidence that *Salt Tolerance5* (*ThST5*) from *Thellungiella halophila* is a promising candidate to improve [salt tolerance](#) in [cotton](#). These findings can take salt-tolerant cotton research to new levels.

ThST5 was previously isolated by the scientists from the halophyte *T. halophila*, an ortholog of Arabidopsis *SPT4* which encodes a transcription elongation factor. However, previous evaluations did not confer *SPT4-2*'s salt tolerance in crops. For this study, the scientists were able to record evidence that *SPT4-2* increases salt tolerance in cotton plants.

The scientists used R15, an upland cotton variety that is highly responsive to genetic manipulations, to test its reaction to the overexpression of *ThST5*, which

Learn more by reading the full paper in the [Journal of Cotton Research](#).

was done by transferring *ThST5:Pcb2004* construct using *Agrobacterium*-mediate transformation method. The transgenic cotton plants showed enhanced salt tolerance to salt stress during seed germination and seedling stage. They also showed improved salinity tolerance and improved yield in field conditions. Further analysis also showed that *ThST5* helped maintain ion homeostasis and that it orchestrated the expression of [genes](#) encoding antioxidants and salt-responsive transcription factors.

In conclusion, the scientists stated that *ThST5* is a positive regulator of salinity tolerance mainly by improving the root system, maintaining intracellular ion homeostasis, cellular reactive oxygen species detoxification, and regulating salt-related transcription factors.

New Transporter Identified to Help Balance Zinc and Iron Homeostasis in Maize

A [maize](#) transporter responsible for the regulation of iron and zinc in balance in maize was identified by a team of Chinese scientists. The discovery provides opportunities for genetic resources and a theoretical basis for developing iron-fortified corn varieties.

Scientists from the Biotechnology Research Institute and Qingdao Agricultural University were responsible for identifying the novel iron-regulated transporter *ZmIRT2*. The transporter was involved in reversing growth defects involving both zinc and iron uptake in mutant yeast. More importantly, its expression in maize caused zinc and iron

To learn more, read the article published in [Plant Cell and Physiology](#) and the news release from the [Chinese Academy of Agricultural Sciences](#).

accumulation in the roots, shoots, and seeds. Further analysis showed that *ZmIRT2* along with *ZmIRT1* and *ZmYS1*, other transporters, previously identified by scientists, all function cooperatively to maintain zinc and iron homeostasis, and that *ZmIRT2* and *ZmIRT1* function together to mediate iron uptake in roots.

This discovery can help maize breeders understand the mechanism of iron absorption in plants and lead to the development of better varieties with high iron contents.

International Research Team Sequences Bread Wheat Genome; Finds Gene for Stripe Rust Resistance

Researchers from King Abdullah University of Science and Technology (KAUST) together with their colleagues from [South Africa](#), France, and the [U.S.](#) have assembled the highest quality [genome](#) to date for bread [wheat](#) cultivar called Kariega, which is a key South African wheat.

Kariega has a robust resistance to stripe rust, one of the three species of wheat rust. Using this genome, the researchers identified and cloned a key [gene](#) that confers stripe rust resistance. The research team identified the stripe rust resistance gene as Yr27, which they then cloned to study the gene function

and molecular mechanisms of resistance. In future breeding efforts, the cloned genes could be transferred to cultivars during breeding, and could even be modified to alter a plant's disease recognition and resistance.

Naveenkumar Athiyannan, who worked on the project alongside KAUST's Michael Abrouk and For more details, read the news article in [KAUST Discovery](#).

Transgenic Sugarcane Field Trials in Indonesia Exhibit Promising Results

Transgenic [sugarcane](#) overexpressing sucrose-phosphate synthase were evaluated under field trial conditions and were found to perform better than its non-transgenic counterparts without affecting bacterial diversity and soil rhizosphere. The field evaluation aids the selection of the best transgenic sugarcane line.

The transgenic sugarcane lines overexpressing the *SoSPSI* [gene](#) from [Indonesia](#) were found to have increased sucrose phosphate synthase activity, sucrose content, and biomass in a previous greenhouse experiment. The lines were then cultivated to undergo field trials in four experimental stations located in different areas with different climate conditions and different soil types in five, randomized block-design replications.

The transgenic sugarcane in field trials exhibited the following:

- higher tiller number and plant height compared to the non-transgenic counterpart;

Read more in [Sugar Tech](#).

RNAi-based GM Potato Plants Exhibit Resistance to Potato Virus Y

Researchers from the Agricultural Biotechnology Research Institute of Iran and partners used gene silencing techniques to develop [genetically modified](#) potato plants resistant to potato virus y (PVY), the most harmful viral disease. The results are published in *Transgenic Research*.

Simon Krattinger said that Yr27 is a version, or allele, of a known leaf rust resistance gene. “Now that we know the exact sequences of both alleles, we may be able to engineer a new version of the gene that recognizes both diseases simultaneously,” he added.

- higher percentage of Brix and Pol % in cane yield in comparison to the non-transgenic counterpart;
- higher cane yield in locations with normal irrigation, but higher Brix and Pol % was observed in areas with less water or dry land;
- bacterial biodiversity and soil rhizome were not affected by the planting of the transgenic sugarcane; and
- transgenic sugarcane did not affect the horizontal gene flow in the soil environment.

The field trials will help in the selection of the transgenic sugarcane line best suited for specific agro-climatic conditions to identify a variety with increased sugar yield intended for sustainable agriculture.

Small interfering RNAs developed from double-stranded RNAs can turn on the immune system in GM plants through the detection of virus transcripts to degrade. Thus, the researchers designed three [RNAi](#) gene constructs based on the PVY [genome](#). Using *Agrobacterium*, GM plants were generated containing the designed constructs, and

analyses showed confirmation of the transformation. Further analysis revealed that over 67% of the GM potato plants were resistant to PVY compared to non-GM plants, which exhibited symptoms of viral infection. Plants generated from the three constructs Read more results in [Transgenic Research](#).

showed similar levels of resistance against PVY. No changes were observed in the physical characteristics of the GM potato plants when compared with the non-GM.

Researchers Analyze Maize's Fertilizer Uptake to Improve Yields

Researchers from Guangdong Academy of Science in [China](#) used a new technique called single cell RNA-sequencing (scRNA-seq) to identify and describe the major cell types in the root-tip of [maize](#) as well as the developmental pathways and [genes](#) involved in various functions. Their study is published in *The Crop Journal*.

grown on two types of media, one with nitrate fertilizer and the other without nitrate. They identified and characterized 11 major cell types of tissue that were found in significantly different ranges. A total of 85 cell type-specific [genes](#) were identified to be involved in nitrate response, with some of them linked to nitrate uptake and metabolism. Additional analysis provided hints about the developmental pathways of different cells.

The root system is vital in the growth and yield of maize plants. Finding out its genetic diversity and response to nitrate at the single-cell level will provide insights into root development and nutrient uptake. Using scRNA-seq, the researchers evaluated over 7,000 cells from the root tips of maize seedlings

The results of the study contribute to the development of more efficient, economical, and sustainable maize crop production.

For more details, read the research article in [The Crop Journal](#).

Plant Breeding Innovations

Scientists Identify Efficient Guides to Develop Herbicide Tolerant Tomatoes Using CRISPR-Cas9

Scientists from the Republic of Korea demonstrated the use of single guide RNAs (sgRNAs) as guides for [CRISPR-Cas9](#) crop transformation to breed herbicide-resistant crops, particularly for the tomato. This new information provides more options for scientists who use [gene editing](#) tools to develop crops with more desirable traits.

through *Agrobacterium* mediated transient expression in tomato cotyledons. The scientists then documented that one sgRNA for *pds* had no significant efficiency, but three sgRNAs for *ALS* had significant efficiency, and that one sgRNA for *EPSPS* also had an editing efficiency. These were the pieces of evidence that the editing of the target sites could be achieved in the transformation process.

The scientists focused on three target [genes](#) for [herbicides](#), namely phytoene desaturase (*pds*), acetolactate synthase (*ALS*), and 5-Enolpyruvylshikimate-3-phosphate synthase (*EPSPS*). These were the targets of sgRNAs to be used with the CRISPR-Cas9 system in the tomato. The sgRNAs were first tested for efficiency

Further tests resulted in 19 transgenic tomatoes which were successfully edited for two *ALS* genes. It was concluded that performing sgRNA efficiency tests before crop transformation was useful to scientists, and that CRISPR-Cas9 can successfully help breed herbicide-resistant crops.

For more information, read the article published by [Applied Biological Chemistry](#).