



Agri Innovation Post

Agri-Biotech News & Views

Edition 7 - June 2019

In this edition of the Agri Innovation newsletter, we report the latest forecast released by Research and Market regarding the gene edited crops that are expected to dominate the market in 2025 owing to the simple, rapid and accurate property of the CRISPR. As a matter of fact, the North America genome editing market is expected to grow with a compound annual rate of 17.2% from 2018-2025. Many edited crops are already in the pipeline for commercial release, including waxy corn, non-browning lettuce and mushrooms, drought tolerant corn, improved soybean oil and low gluten wheat etc.

Multiple nations that include US, Canada, Japan, Argentina, Brazil, Chile and more recently Australia and Russia have put policies in place that do not regulate edited crops that have no foreign genetic material inserted. Russia has pledged to create ten new varieties of gene-edited crops and animals by 2020 with barley, sugar beet, wheat and potatoes as their top priority. Fourteen EU nations have requested for a unified approach on gene editing and called for a revision of EU rules.

The Max Planck Society has also formulated a position paper on genome editing. The paper calls for edited plants that are similar to those generated by the natural process of mutagenesis to be no longer classified as genetically modified.

India too is in the process of formalizing regulatory policies for gene edited organisms and their products. We eagerly await the guidelines to take forward the technology to the farmers.

Dr. Shivendra Bajaj

Executive Director

Federation of Seed Industry of India-Alliance for Agri innovation

AgBiotech News

[HC notice to Centre over sale of GM food article](#)

[Times of India]

Rajasthan High Court has issued notice to the Union cabinet secretary, Union food and environment ministries over the sale of food articles using genetically modified agricultural produce. The petitioner said, GM food article are sold and imported in large quantities to the country taking advantage of the loop holes in the system.

[Haryana's Bt brinjal row: Govt must allow farmers to have access to technologies in agriculture to dissuade illegal use of seeds](#)

[First Post]

Tests conducted by the National Bureau for Plant Genetic Resources (NBPGR) at the instance of the Haryana government have found that while the Fatehabad brinjal sample has been genetically modified, it does not contain Mahyco's cry1Ac transgene. This was confirmed by sources in NBPGR, ICAR and the Indian Agricultural Research Institute (IARI). The brinjal farmers want relief from high pesticide costs, he said. Farmers should be given freedom to access technology, and if governments did not permit even those considered safe after extensive tests to please their political constituencies, farmers would have no recourse but to defy unjust decisions.

[Goa looking at Israel for farming solutions: Vijai Sardesai](#)

[BTV India]

Goa is looking at Israel to increase productivity and profitability in the farming sector, as per Deputy Chief Minister Vijai Sardesai. The Indian delegation was hosted at the prestigious Agricultural Research Organisation, Volcani Center, which is under Israel's ministry of agriculture. Mr.Sardesai said he discussed the use of cutting edge technologies, like precision farming and agro-nanotechnology for food quality enhancement and plant protection, model farms for sustainable farming practices, soil conservation, waste water irrigation, new breeding techniques and new strains of crops among other things, with the Israeli officials.

[Huge quantity of illegal cotton seed seized](#)

[The Hindu]

The illegal supply of Herbicide Tolerant (HT) cotton seed in the State surfaced again after the police busted a gang that 'smuggled' this brand of seed from Gandhinagar in Gujarat. On a tip-off, the sleuths of Hyderabad Commissioner's Task Force North Zone team intercepted a commercial vehicle near outward parcel office of Secunderabad Railway Station and found a huge quantity of unauthorised HT cotton seed.

Ag Biotech News Around the World

[Non-browning lettuce is making its way to the market](#)

[AGDaily]

Intrexon Corporation announced it is advancing their non-browning lettuce, GreenVenus Romaine lettuce, to commercial trials. Initial data under commercial indoor production conditions indicate that GreenVenus has an improved shelf-life of up to two weeks and a potential for higher marketable yield with no tip burn. In addition to improved shelf life, GreenVenus non-browning lettuce has been assessed by the USDA and determined not to be subject to regulation under 7CFR Part 340 for plants altered or produced through genetic engineering.

[Max Planck Society publishes statement on genome editing | Max-Planck-Gesellschaft](#)

[Max Planck Website]

The rapid development of CRISPR/Cas technology and other genome-editing techniques raises a variety of scientific, legal and ethical questions. The Max Planck Society has decided to contribute the expertise of its scientists to foster scientific and societal debate on the subject. It has therefore formulated its position on genome editing in a position paper. The paper considers the current state of our knowledge insufficient to justify, among other things, modifying the human germline. It also calls for European legislation to be adapted to the current state of research and for plants with edited genetic material to be no longer be classified as genetically modified if they imitate the natural process of mutagenesis.

[14 EU countries call for 'unified approach' to gene editing in plants](#)

[EurActiv]

The Netherlands and Estonia are leading a coalition of 14 EU member states calling on the next European Commission to update EU GMO laws with regard to so-called new plant breeding techniques (NPBTs). According to an EU source, the group of countries requested a common EU approach on gene editing and called for a revision of EU GMO rules to be added to the working programme of the next European Commission. In their opinion, an update has become necessary after the European Court of Justice (ECJ) issued a ruling last year saying organisms obtained by mutagenesis should be considered GMOs and therefore subject to the safety and marketing obligations laid down in the EU's GMO directive.

[Brazil approves new soy seed that resists drought, two herbicides](#)

[Reuters]

Brazil's bio-security agency CTNBio has approved a new soybean seed that combines technologies to make it resistant to drought and two widely used herbicides. Completion of the regulatory process allows the planting and harvesting of the so-called HB4 soybean varieties in Brazil, the statement said, although commercial launch for export will require approval from importing countries. The HB4 trait has been approved in Argentina and by the U.S. Food & Drug Administration, regulatory approvals are also under consideration by the U.S. Department of Agriculture, as well as in China, Paraguay, Bolivia and Uruguay.

[EU Commission prepares for possible 'overhaul' of GMO crop rules to address CRISPR gene editing](#)

[GLP]

The European Court of Justice (ECJ) said last July that organisms obtained by mutagenesis, or gene editing, plant breeding technique are genetically modified organisms (GMOs) which should therefore fall under the GMO Directive. The EU executive has already prepared the ground for a new initiative on gene editing to overhaul the current GMO legislation, EU agriculture commissioner Phil Hogan has said.

[Australian scientists eager to begin CRISPR crop research as deregulation deadline nears](#)

[GLP]

GM crops continue to produce productivity gains and environmental benefits worldwide, although those benefits are mostly limited to cotton and canola in Australia. Ian Godwin is the Director of the Centre for Crop Science at QAAFI at the University of Queensland said that his team was ready to plant field trials of our gene edited sorghums with larger grain and more protein. Most of North and South America, Japan and Russia are full steam ahead with gene editing in agriculture.

[US TO HELP PAKISTAN INTRODUCE GE CORN](#)

[CROP BIOTECH UPDATE]

The Foreign Agricultural Service (FAS) of the United States Department of Agriculture (USDA) has announced that future collaborative projects between the U.S. and Pakistan would include using American soybean feed in poultry, fish farming, and dairy industries; introducing genetically engineered (GE) maize; and working with various government agencies to develop uniform food safety standards.

[UC PROFESSOR EMERITA EMPHASIZES ON GENE EDITING TO ACHIEVE SUSTAINABILITY NEEDS](#)

[CROP BIOTECH UPDATE]

University of Canterbury's (UC) newest Professor Emerita Paula Jameson has spoken about how important it is to consider gene editing as a tool to improve crop production to meet the sustainability demands of New Zealand. While it is true that genetically engineered plants are not planted in New Zealand, the public has been consuming genetically engineered products like soybean and canola for years. She urges Aotearoa New Zealanders to become more aware of the benefits of gene editing,

because gene-edited plants have more potential to increase yield and fight off environmental stress to help achieve New Zealand's sustainability targets.

[Golden Rice, part 1: The story of a GMO crop that could benefit two billion children a year](#)

[GLP]

The Golden rice inventors, Professor Ingo Potrykus and Dr Peter Beyer, assigned their patents to Syngenta for commercial exploitation as part of a transaction which obliged the company to assist the inventors' humanitarian and altruistic objectives. Product development was initiated through the International Rice Research Institute (IRRI) and the network. The whole network, including IRRI, worked to a common set of goals defined in licences each institution signed with the inventors. The terms included that there would be no charge for the nutritional technology and it would only be introduced to publicly owned rice varieties.

[Russia embraces gene-edited crops](#)

[Nature-news]

Russia has pledged to create ten new varieties of gene-edited crops and animals by 2020 — and another 20 by 2027. Barley, sugar beet, wheat and potatoes will be the top priorities of the 111-billion-ruble (US\$1.7-billion) programme. Critics have expressed doubts that the goals can be met on time, and worry that the initiative does not address the other issues that scientists in Russia face, such as excessive bureaucracy.

[John Innes Centre battles nutrient deficiency with iron-fortified biotech wheat](#)

[GLP]

Iron is an important micro-nutrient, boosting haemoglobin levels in the blood. Many populations and particularly women and children are currently deficient in iron. Traditional breeding attempts to create a high-iron wheat variety have failed, so now our scientists are using genetic engineering to boost levels of this important micronutrient.

[North America genome editing market projected to increase by 2025](#)

[Research and Markets]

The North America genome editing market is expected to reach US\$ 4,148.1 million in 2025 from US\$ 1,234.5 million in 2017. The market is estimated to grow with a compound annual rate of 17.2% from 2018-2025. These are according to the latest forecast released by Research and Markets. The rise of the genome editing market is primarily attributed to the increased adoption of GM crops and the increasing prevalence of genetic diseases. However, the strict regulations implemented on genome editing may cause a negative effect on market growth. In 2017, the CRISPR segment held the largest market share of 53.6% of the genome editing market, by technology. This segment is also expected to dominate the market in 2025 owing to the simple, fast and accurate property of the CRISPR.

[Nigeria approves two GMO cotton varieties in bid to boost output](#)

[Bloomberg]

Nigeria approved two genetically modified varieties of cotton for use by the nation's farmers to help boost supply to its textile industry and cut lint imports of as much as 115 billion naira (\$319 million) a year, officials said. The strains were modified by the Institute of Agricultural Research at the Ahmadu Bello University in the northern city of Zaria in collaboration with privately owned Mayco Nigeria Ltd. to include a gene that makes it pest resistant, according to Rose Gidado, assistant director at the Abuja-based National Biotechnology Development Agency.

[Ghana farmer groups demand accelerated approval of GMO crops](#)

[Cornell Alliance for Science]

Farmers in northern Ghana are calling on their government to speed up the commercialization of genetically modified (GM) crops in the country. During a media briefing in Tamale, representatives of farmer groups under the coalition of Concerned Farmers of the Northern Region expressed their concern about the continuous decline of cotton and cowpea production in that part of the country. They attribute such decline to repeated pest attacks and are confident that GM crops will help them deal with such problems. The coalition includes the Northern Farmers Association, Juni Farmers Association, Northern Livestock Farmers Association, and the Northern Outgrowers and Business Association.

[Sustainable and Pro-GMO Chocolates Now Available to the Public](#)

[A Fresh look]

After its successful debut in February, the sustainable and unabashedly pro-GMO Ethos Chocolate is again available to the public. Produced by A Fresh Look, a US-based family farmer-led nonprofit organization working to educate people about GMOs, Ethos Chocolate bars are created by artisanal chocolatiers at SPAGnVOLA and their family-run cacao farm in the Dominican Republic. However, unlike most chocolate lines in the market today, Ethos Chocolate tells a story -- that of the benefits and products of biotechnology.

[Argentina, Brazil, Canada, & U.S. to collaborate on biotechnology](#)

[AGDaily]

The Ministers of Agriculture from Argentina, Brazil, Canada, and the United States highlighted that food demand is rising while agricultural production faces significant constraints, such as limited access to arable land and fresh water. In this regard, they agreed that agricultural innovation, such as biotechnology, including precision biotechnology, will continue to play a substantial role in addressing such challenges and can improve farmers' productivity in a safe and sustainable manner. In addition, these ministers recognized that the number of biotechnology crops being developed and cultivated worldwide is increasing annually but regulatory differences have increased risk of trade disruptions.

[Benefits of GMOs in gardens: The myths and science](#)

[Farm and Dairy]

Overall, scientists say GMOs have reduced chemical pesticide use, both herbicides and insecticides, by 37%. The most commonly developed genetically modified (GM) crops are corn, soybeans and cotton, but Ron Goldy, senior Michigan State University Extension educator, says that technically all domesticated plants are genetically altered in the sense that they were generated using traditional breeding methods and contain a mixture of parental genes. Genetically modified plants allow a producer to lower and eliminate certain pest control strategies.

[GMO arctic Fuji gains final U.S. approval](#)

[Capital Press]

Okanagan Specialty Fruits Inc., developer of genetically modified non-browning apples, on April 26 received U.S. Food and Drug Administration approval to sell its new Arctic Fuji variety in the U.S. The FDA previously approved Arctic varieties of Golden Delicious and Granny Smith apples in 2015. The first 40,000 to 50,000 pounds of fresh-sliced, snack-pack Arctic apples were sold in the Midwest and Southeast in November of 2017. The apples are genetically modified to prevent browning when sliced, bitten or bruised. It was done by "silencing" a gene and reducing the enzyme polyphenol oxidase. It allows OSF to tout its fresh and dried sliced apples as preservative free. Other manufacturers of fresh and dried sliced apples use chemical additives to prevent browning, but it can alter flavour.

[Defra approves GM camelina field trials](#)

[Crop biotech update]

The United Kingdom's Department for Environment, Food and Rural Affairs (Defra) has given permission for Rothamsted Research to run a series of field trials using genetically modified (GM) Camelina plants.

[Pepsi's dropped lawsuit over patented potato raises global questions about intellectual property](#)

[GLP]

PepsiCo Inc., which owns Lay's, withdrew their lawsuits against the Indian farmers after discussions with the government. Pepsi officials say they created the FC5 variety, which has a reduced moisture content making it better to better make potato chips with. Officials had initially said the four farmers were infringing on a patent on the FC5 variety of potatoes saying they would drop the lawsuit if farmers chose to sell their crops to Pepsi, or stop growing them.

[Does Big Ag control farmers through seeds patents? Farmers don't think so.](#)

[GLP]

Despite the number of corporate mergers (such as the purchase of Monsanto by Bayer), farmers still have a wide range of choices for seeds, including conventional and genetically modified. And many farmers, for economic and production reasons, rather than because of legal restrictions, often are not interested in saving and planting seeds from their current crops. Farmers said they had choices of seeds to plant, and not one of them said they felt pressure to choose one type of seed over another.

[Australia updates gene technology regulations; Will not regulate gene editing in plants without new genetic material](#)

[Crop Biotech Update]

The Australian government has released a decision that says it will not regulate the use of gene editing techniques in plants, animals, and human cells that do not introduce new genetic material. The decision comes from a review of the country's gene technology regulations and changes will take effect on October 8, 2019.

New Research

[Neighbouring crop diversity mediates the effect of Bt cotton on insect community and leaf damage in fields](#)

[Transgenic Research]

A comprehensive survey was conducted to investigate the number of species, population abundance, community evenness and dominance of insects and weeds as well as leaf damage to weeds in Bt and non-Bt cotton fields at 27 sites across northern China. The role of neighbouring crop diversity around cotton fields in controlling insects and weeds in the cotton fields was also assessed. The leaf damage to Bt and non-Bt cotton negatively associates with the diversity of neighbouring crops in cotton fields. The study demonstrates the neighbouring crop diversity mediates the effects of Bt crops on agricultural diversity in complex interactions among transgenic crops, in-field weed and insect communities, and neighbouring crops.

[Single crossover-mediated targeted nucleotide substitution and knock-in strategies with CRISPR/Cas9 system in the rice blast fungus](#)

[Scientific Reports]

A series of novel strategies to increase the efficiency of targeted gene disruption and new gene "introduction" using the CRISPR/Cas9 system in the rice blast fungus *Pyricularia (Magnaporthe) oryzae* have been established by Tokyo University of Science. These strategies include quicker (single-step) gene introduction, use of small homologous sequences, and bypassing of certain prerequisite host DNA "patterns" and host component modification. Rice blast fungus is an important pathogen that causes destructive disease of rice and novel CRISPR/Cas9-based genome editing technique developed, can speed up molecular biological research on the pathogen

[Tomato pan-genome makes bringing flavor back easier](#)

[Science Daily]

Scientists at ARS Plant, Soil and Nutrition Research Laboratory and BTI bioinformatics in Ithaca, New York, have finished constructing the pan-genome for the cultivated tomato and its wild relatives, mapping almost 5,000 previously undocumented genes. The pan-genome helps identify what additional genes beyond the reference might be available for crop breeding and improvement. The scientists expect the addition of nearly 5,000 genes to the tomato genome repertoire will provide additional opportunities for improvement as their roles in tomato biology and fruit quality are determined.

[Transposon insertion causes cadherin mis-splicing and confers resistance to Bt cotton in pink bollworm from China](#)

[Scientific Reports]

Insect resistant Bt crops are widely grown in many countries all over the world to prevent pest attacks in highly economical crops. However, the ability of pests to rapidly evolve resistance reduces the efficacy of Bt crops. Scientists from Hubei Academy of Agricultural Sciences and Chinese Academy of Agricultural Sciences have reported that transposon insertion causes cadherin mis-splicing and confers resistance to Bt cotton in pink bollworm, a devastating pest of cotton globally. The similar resistance of pink bollworm to Cry1Ac in laboratory- and field-selected insects from China, India and the U.S. provides a basis for developing international resistance management practices.

[Targeted deletion of rice retrotransposon *Tos17* via CRISPR/Cas9](#)

[Plant Cell Reports]

A successful example of transposon deletion using CRISPR-Cas9 as an alternative technique for plant breeding was presented by experts from National Agriculture and Food Research Organization (Japan) and Yokohama City University. Intentional alteration of loci adjacent to transposons using genome editing could mimic the naturally occurring translocation of transposons, and lead to development of novel plants. Thus, the researchers performed targeted deletion of *Tos17* retrotransposon, which is flanked at both ends by long terminal repeat (LTR) sequences, through genome editing in rice.

[Robust CRISPR/Cpf1\(Cas12a\) mediated genome editing in allotetraploid cotton \(*G. hirsutum*\)](#)

[Plant Biotechnology Journal]

Various kinds of gene editing tools are necessary for functional genomic research in cotton, a plant species with a very complex genome. CRISPR-Cpf1, a new addition to the CRISPR-Cas9 system, has three common types of Cpf1 for genome editing: AsCpf1, LbCpf1 and FnCpf1. Recent research has shown that CRISPR-Cpf1 have been used successfully on rice, soybean, tobacco, and maize. Results indicated that the CRISPR-Cpf1 system for cotton genome editing has a very high efficiency (87%) with no off-target effects observed. The mutated characteristics were also found to be inherited by the next generation.

[Sustainable way to Increase seed oil yield in crops](#)

[Science Daily]

Nanyang Technological University, Singapore (NTU Singapore) scientists have developed a sustainable way to demonstrate a new genetic modification that can increase the yield of natural oil in seeds by up to 15 per cent in laboratory conditions. The new method can be applied to crops such as canola, soybean and sunflower, which are in a multi-billion dollar industry that continues to see increasing global demand. In the lab, these modified seeds have successfully displayed seed oil increase that is able to produce up to 15 per cent more natural oils.

[Cautionary tale for crop gene editing](#)

[Science Daily]

Unexpected interactions between mutations can be a thorn in the side for plant breeders. Scientists unveil what drove one infamous 'cryptic' mutation. Even in this "age of the genome," much about genes remains shrouded in mystery. This is especially true for "cryptic mutations" -- mutated genes that are hidden, and have unexpected effects on traits that are only revealed when combined with other mutations. Learning from one infamous cryptic mutation in particular, researchers from CSHL share important lessons for breeding or gene editing in crops.

[CRISPR-Cas9 Editing in Maize: Systematic evaluation of off-target activity and its relevance in crop improvement](#)

[Nature- Scientific Reports]

CRISPR-Cas9 enabled genome engineering has great potential for improving agriculture productivity, but the possibility of unintended off-target edits has evoked some concerns. In the report they have employed a three-step strategy to investigate Cas9 nuclease specificity in a complex plant genome. They conclude that with well-designed guides, genetic variation from Cas9 off-target cleavage in plants is negligible, and much less than inherent variation.

[Characterization of cadmium-responsive MicroRNAs and their target genes in maize \(*Zea mays*\) roots](#)

[BMC]

To investigate the role of miRNAs in response to Cd stress, roots of seedlings of the inbred maize lines B73 and Mo17 were collected and treated with 200 mg/L CdCl₂·2.5 H₂O over different exposure times. The results showed that miRNAs and their respective target genes were differentially expressed in maize seedling roots exposed to Cd stress. This research produced new insights into the molecular mechanism of miRNAs responsive to Cd stress in plants and sheds light on the latent roles of miRNAs in plants exposed to heavy metal stresses.

[Plant breeding at the speed of light: the power of CRISPR/Cas to generate directed genetic diversity at multiple sites](#)

[BMC Plant Biology]

Experts from Karlsruhe Institute of Technology in Germany described the CRISPR-Cas9 system and its ability to generate directed genetic diversity at multiple sites. They referred to the system as a tool for plant breeding at the speed of light. The review article is published in *BMC Plant Biology*. According to Felix Wolter and co-authors, conventional plant breeding methods have successfully generated high yielding crop varieties. However, the long process of development has impoverished the genetic diversity available for breeding. With the CRISPR-Cas9 system, there are new opportunities to improve genetic diversity like never before. Because of its multiplexing ability, multiple targets can be modified at the same time efficiently, allowing immediate pyramiding of several desired traits into an elite background within one generation.

[Effect of drought stress on the genetic architecture of photosynthate allocation and remobilization in pods of common bean \(*Phaseolus vulgaris* L.\), a key species for food security](#)

[BMC Plant Biology]

Common bean is the most important staple grain legume for direct human consumption because of its high nutritional value. To maximize its nutritional potential, scientists aimed to improve its resistance to various stresses. Previous studies showed that photosynthate remobilization and partitioning is one of the major mechanisms of drought tolerance and overall productivity in common bean. Thus, scientists from the University of California, Davis aimed to determine the inheritance of pod harvest index (PHI) a measure of the partitioning of pod biomass to seed biomass, relative to that of grain yield.

[CRISPR/Cas9-mediated functional recovery of the recessive *rc* allele to develop red rice](#)

[Plant Biotechnology Journal]

Editing was used to successfully converted three elite white grain rice varieties into rice plants with red grains, producing high levels of proanthocyanidins and anthocyanidins. Furthermore, no significant change in major agronomic traits was observed in the mutants compared to the wild type, implying that restoring the *Rc* function had no effect on agronomic traits in rice.

[Development of a haploid](#)

[inducer mediated genome editing system for accelerating maize breeding](#)

[Molecular Plant]

Chinese Academy of Agricultural Sciences researchers developed a Haploid-Inducer Mediated Genome Editing (IMGE) approach, which uses a maize haploid inducer line carrying a CRISPR-Cas9 cassette targeting for a desired traits to pollinate an elite maize inbred line and to generate genome-edited haploids in the elite maize background. Through this new approach, homozygous pure DH lines with the desired trait could be generated in just two generations, avoiding the long procedure of repeated crossing and backcrossing done in conventional breeding.

Upcoming Events

June 2019

ISF World Seed Congress 2019 – International Seed Federation

Date: June 3 – 6, 2019

Venue: Nice, France

12th World Congress on Plant Biotechnology and Agriculture

Date: June 12 – 13, 2019

Venue: Prague, Czech Republic

International Seed Testing Association Congress (ISTA Congress)

Date: June 26 – 3 July, 2019

Venue: Hyderabad, India

Biotech France

Date: June 26 – 28, 2019

Venue: Issy-les-Moulineaux, France

PHOTOSYNTHESIS CONFERENCE 2019

Date: June 30 – July 3, 2019

Venue: Brisbane, Australia

July 2019

International Conference on Plant Transformation & Biotechnology (PTB)

Date: July 03 – 04, 2019

Venue: Vienna, Austria

Plant Genome Editing & Genome Engineering

Date: July 05 – 06, 2019

Venue: Vienna, Austria

13th International Conference on Agriculture and Plant Science

Date: July 12 – 13, 2019

Venue: Osaka, Japan

International Conference on Agricultural and Biological Science (ICABS)

Date: July 24 – 25, 2019

Venue: Sydney, Australia

August 2019

International Agriculture & Horti Expo

Date: August 1-3, 2019

Venue: New Delhi, India

International Conference on Plant Tissue Culture and Plant Biotechnology

Date: August 1-2, 2019

Venue: Amsterdam, Netherlands

Milan International Conference on Agricultural, Biological and Environmental Sciences (MABES)

Date: August 5-7, 2019

Venue: Milan, Italy

International Conference on Agriculture and Food Security (AGROFOOD)

Date: August 8-9, 2019

Venue: Colombo, Sri Lanka

International Conference on Plant Science and Molecular Biology

Date: August 19-20, 2019

Venue: Osaka, Japan

The Seeds of Our Future: Innovating Global AgTech

Date: August 20-23, 2019

Venue: San Jose, USA