Agri Innovation Post | Edition 27
Agri-Biotech News & Views | February 2021

Alliance for Agri Innovation (AAI), Federation of Seed Industry of India (FSII) and University of Agricultural Sciences, Bangalore jointly organised a virtual International Conference on the topic '**Current Scenario & Path forward for GM crops in India**'. It saw discussions on new technologies that can address the problems of food insecurity, climate change while reducing expenses on crop inputs. The many hurdles in allowing the commercial release of genetically modified (GM) crops was also discussed. The speakers and audiences during the discussion pointed out that scientific data-based scrutiny of the GM technology is required and there is a need for public awareness to clear speculations about the technology. More than 500 participants who joined the conference included scientists, researchers, biosafety regulators, government officials, students, academicians and general public.

Dr S Rajendra Prasad, Vice Chancellor, University of Agricultural Sciences (UAS), the chief guest of the event, reminded the audience of how Bt cotton had benefitted India and the world tremendously and there had not been a single proven evidence of ill- effects of biotech crops in human or animal health. WHO, FAO, OECD have also reiterated the biosafety of GM crops across the globe with examples in several crops. India needs to emulate the success of Bt Cotton in other critical crops like soyabean, groundnut and mustard where yields are stagnant now. He said that hybrid technology and GM crops were chosen by experts to bring the next green revolution.

Mr Ram Kaundinya, Director General, Federation of Seed Industry of India (FSII) brought forward the deadlock in GM approvals in India, as there has not been a fresh approval to GM crops since 2005. In his opinion, the current regulatory stalemate had resulted post 2010 moratorium on Bt brinjal followed by the hold on GM mustard since 2017. Though questions have been raised about safety, regulatory process, seed sovereignty associated with GM cultivation, farmers have been positive as is evident from their demand for Bt Brinjal, HT Cotton and other technologies, which will be very critical for their success and competitiveness in the international market.

Dr C S Prakash, Dean and Professor (Plant Genetics, Genomics and Biotechnology), Tuskegee University, mentioned that humans have been modifying crops for thousands of years, ever since hunters-gatherers started cultivating, selecting plants to start agriculture. The wild ancestors of crops like maize, tomato and many other crops have been selected and

modified over several thousand years and transformed into the incredible high yielding crops that we see today. India's reluctance in approving Bt Brinjal has benefited Bangladesh, as it approved, planted and is reaping benefits of Bt Brinjal. Instead, Indian farmers lost a technological advantage, it also impacted scientific talent, research investments and pipeline in the country.

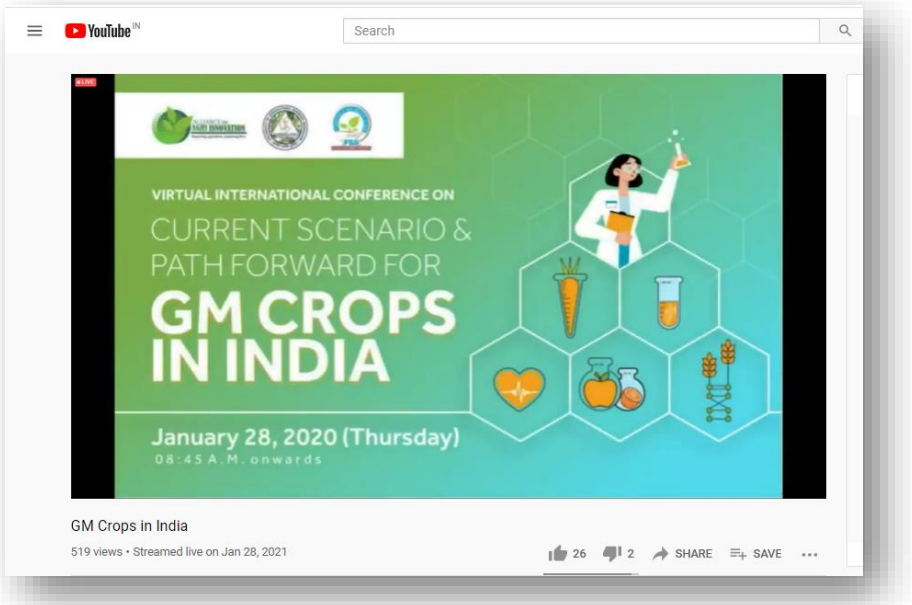
Dr Vibha Ahuja, Chief General Manager, Biotech Consortium, said that there was a need for reasonable science-based risk assessment of GM crops since they have novel or modified characteristics. The focus of risk assessment should be probabilistic but not speculative ones. There should be discussion on risks that can be evaluated by empirical means rather than based on unsubstantiated possibilities. If there are uncertainties around assessments or inadequate data, it can be resolved through further studies, however, it was very discouraging scenario for all concerned when decisions are delayed.

Dr Wayne Parrott, Program Director, Institute of Plant Breeding, Genetics & Genomics, University of Georgia, spoke about Gene editing technology and its potential in agriculture. Regarding the regulations associated with Gene edited crops, he mentioned that the world was in the state of a flux and most nations were in the process of defining and finetuning regulations and different countries were using different trigger points to decide if something was to be regulated. In his opinion both GMOs and genome editing were necessary for agricultural improvement.

Expressing concerns over activism against GM technology, **Dr S R Rao, former advisor to Department of Biotechnology, Government of India** said that regulations that started in 1975 have been updated and developed in keeping with technology development. It was agreed that regulators and scientists should actively create awareness regarding the technology and press for a science basedscience-based evaluation and approval of GM crops.

A recommendation is in the stages of development where excerpts and way forward for these technologies will be submitted to The Government of India to demonstrate the exasperation of farmers and urgency of the scientist and industry in bringing these technologies. Adoption of these technologies in right time is crucial to accrue the benefits.

The link of the International Conference is provided below for your viewing. In this newsletter we have also covered news around several important developments on agriculture across India, globally and in the area of research. We hope you find it a good read!



Link - https://www.youtube.com/watch?v=-kICOyci_ss

Shivendra Bajaj
Executive Director
Federation of Seed Industry of India

News from India and Around the World

Union Budget 2021: Govt should focus on R and D in agriculture, raise outlay, help farmers to diversify crops

(First Post)

Conventional or genomics-assisted breeding cannot make pigeon pea, chickpea or soybean resistant to borers. These need GM technology. This has been used in cotton to make it resistant to worms that bore into bolls. More than 90 percent of India's cotton has this technology. In October 2019, the US Food and Drug Administration approved gossypol-free cottonseed produced with gene-silencing RNAi technology. The public is squeamish about GM technology because it involves the transfer of genetic traits from other species. It should have no qualms about genome editing which can be used to create plants with traits akin to those derived from conventional breeding but with the undesirable traits excised out or silenced. The environment ministry published the draft regulations for genome editing in January 2020. They have not yet been finalised.

Novel trait clarification could prove significant

(The Western Producer)
Health Canada plans to publish a new guidance document that could have a profound impact on crop breeding in this country. The document will clarify what the government deems to be plants with novel traits, which are crops that are subject to regulation. Seed companies hope the new definition will create a more predictable and transparent system for crop breeders. Ian Affleck, vice-president of plant biotechnology with CropLife Canada said that they are encouraged to see that the government is taking this very seriously. They recognize it's a priority and they're moving forward on consultations to modernize their framework. He worries that Canada is falling behind other countries like the United States, Australia, Argentina and Japan on how to handle new breeding techniques, such as gene editing. Those jurisdictions have decided that gene editing technologies such as CRISPR do not require the same pre-market assessment that genetically modified crops require because the same outcome could be achieved through conventional breeding.

FSII holds high-level virtual conference addressing challenges for GM crops in India

(AgroSpectrum)
A virtual International Conference was conducted by Federation of Seed Industry of India (FSII), Alliance for Agri Innovation and University of Agricultural Sciences, Bangalore on the topic 'Current Scenario & Path forward for GM crops in India'. It saw discussions on how new technologies can address the problems of food insecurity, biotic and abiotic stresses, reducing expenses on crop inputs and hurdles in allowing the genetically modified (GM) crops for commercial release. More than 500 participants who joined the conference included scientists, researchers, biosafety regulators, government officials, students, academicians and the general public. The speakers and audiences during the discussion pointed out that scientific data-based scrutiny of the GM technology is required and there is a need for public awareness to clear speculations about the technology.

Infographic: Here's where GM crops are grown around the world today

(GLP)
In 2019, 29 countries from all over the world planted 14 biotech crops, led by the top five countries USA, Brazil, Argentina, Canada, and India. The USA remains the largest producer of biotech crops in the world, planting 37.6% of the global biotech crop area. Ten biotech crops were planted in the USA in 2019, including maize, soybeans, cotton, alfalfa, canola, sugar beets, potatoes, papaya, squash, and apples. In Latin America, ten countries led by Brazil planted biotech crops in 2019. Biotech soybeans are the most planted crop in the region. Brazil is the top developing country planting biotech four biotech crops, soybeans, maize, cotton, and sugarcane.

IIT-Kharagpur, NABARD to conduct first Agri-Food Techathon

(Krishijagran)
Together with NABARD, IIT Kharagpur is hosting the first Agri-Food Techathon of its kind (AFT 2021) to encourage the participation of young people in creativity and entrepreneurship in various fields of the agri-food industry. The event is being organised in collaboration with NABARD by the Department of Agricultural & Food Engineering, the Centre for Rural Growth & Creative Sustainable Technology and the Rajendra Mishra School of Engineering Entrepreneurship.

Why do we need gene-edited crops? To make farming more sustainable

(ISAAA)
Crop productivity is hugely impacted by pathogens. Pathogen-specific pesticides are commonly applied to protect plants, however, excessive use can cause damaging effects to the environment. Thus, researchers strive to improve crops by boosting their resistance to pathogens. This can be achieved through conventional breeding methods, but such techniques are labor-intensive and time-consuming. Gene editing tools are used to genetically engineer crops to have better resistance against pathogens. One of these tools is known as transcription activator-like effector nucleases or TALENs. TALENs have been successfully applied in rice to engineer resistance to Xanthomonas oryzae, the pathogen that causes bacterial blight. Scientists have also used TALENs to engineer resistance to powdery mildew in wheat. With the use of TALENs and other gene-editing tools, improving the biotic resistance of crops through chemical-free approaches is made possible.

Indian research can help cut nitrogen fertiliser waste

(Down to Earth)

A group of Indian scientists have found a way to improve crops by reducing wastage of nitrogen fertilisers applied to them. They were able to identify phenotypes, or visibly identifiable features that determine the efficiency with which cultivated rice varieties (cultivars) use nitrogen. This efficiency is known as nitrogen-use efficiency (NUE). The group lead by N Raghuram of Guru Gobind Singh Indraprastha University, Delhi, also identified genes associated with the identifiable features that can improve crops further. The research involving interdisciplinary research in biotechnology, crop physiology, agronomy, soil science, statistics and bioinformatics was published in journal Frontiers in Plant Science.

UMD researcher expands plant genome editing with newly engineered variant of CRISPR-Cas9

(Eureka Alert)

Alongside Dennis vanEngelsdorp, associate professor at the University of Maryland (UMD) in Entomology named for the fifth year in a row for his work in honey bee and pollinator health, Yiping Qi, associate professor in Plant Science, represented the College of Agriculture & Natural Resources on the Web of Science 2020 list of Highly Cited Researchers for the first time. This list includes influential scientists based on the impact of their academic publications over the course of the year. In addition to this honor, Qi is already making waves in 2021 with a new high-profile publication in Nature Plants introducing SpRY, a newly engineered variant of the famed gene editing tool CRISPR-Cas9. SpRY essentially removes the barriers of what can and can't be targeted for gene editing, making it possible for the first time to target nearly any genomic sequence in plants for potential mutation. As the preeminent innovator in the field, this discovery is the latest of Qi's in a long string of influential tools for genome editing in plants.

Africa biotech setback: Tanzania suspends GM crop research, ending trials of insect-resistant corn and virus-resistant cassava

(IPP Media)

Agriculture minister Prof Adolf Mkenda made an announcement at the Tanzania Agricultural Research Institute (TARI) Mikocheni centre in Dar es Salaam, saying the decision has been made to conserve genetic resources of the country and local seed varieties. This implies that the drought-tolerant GMO maize trial that has been ongoing and another for cassava at TARI Mikocheni will halt operations forthwith. The maize project sought to tackle periodic infestation of fall armyworm while the cassava trial was meant to end diseases such as the brown streak virus.

Israeli start-up says it has edited cannabis plant gene to resist fungus

(Times of Israel)

Israeli start-up said it has used gene editing technology to alter a gene in the cannabis plant to make the plant resistant to powdery mildew, a fungus that can be deadly for the plant. The company said that to the best of its knowledge, this is the first time a commercial company has managed to perform genome editing on a cannabis plant. The editing was done using CRISPR-Cas9 gene editing technology. “It is very hard” to use the CRISPR technology on the cannabis plant, said Ido Margalit, the CEO. Through this technology, the start-up’s R&D team, composed of geneticists, molecular biologists and agronomists, edited a gene that expresses a protein responsible for creating sensitivity to powdery mildew infection, he said.

Employ gene editing, nanotechnology in farming: experts

(The Hindu)

Kerala should take advantage of new tools such as gene editing and nanotechnology-based solutions in its efforts to bridge the yield and position agriculture as a driving force for the State’s progress, speakers at the Kerala Looks Ahead conclave organised by the State Planning Board said. Genome-edited crops can aid Kerala’s efforts to increase crop yield in addition to reducing dependence on chemical fertilizers and pesticides and cutting down on post-harvest losses, Kathleen L. Hefferon, professor of microbiology at Cornell University, U.S., suggested.

New camelina variety has bioplastic in its seeds

(The Western Producer)
Last fall, a fast-food giant announced it is testing a new straw at about 250 stores. The straw is biodegradable and is made from a natural chemical called PHA, also known as polyhydroxyalkanoates. The straws have the same look and feel as traditional plastic, the PHA material is both marine and soil biodegradable, as well as home and industrial compostable, creating significant environmental advantages over plastic. The PHA used to make the biodegradable straw could represent a huge opportunity for western Canadian farmers because a Massachusetts company has developed a camelina plant that produces PHA bioplastic in its seed. If everything goes according to plan, prairie farmers could be growing tens of thousands of acres of PHA camelina. And the biopolymers in the seed will be made into bioplastics, such as straws, shopping bags and containers for take-out food.

BBC launches 8-part series on future of food & agriculture

(Agdaily)
With the global population expected to rise to 10 billion in the next 30 years, the United Nation predicts that food production will need to double by 2050. Many people are asking how this can be done in an environmentally sustainable way, given dwindling resources such land and water and the threat that climate change poses to food production? Failure to do this properly could leave millions of people around the world food insecure. In a new eight-part multi-platform series called Follow the Food, sponsored by Corteva Agriscience, BBC World News, and BBC.com explore the stories behind feeding the world's ever-growing population. Presented by renowned Botanist James Wong, the series will examine how farming, science, AI technology, and the consumer can overcome this challenge — while also asking whether the ag industry can do so in a way that doesn't harm the planet.

Creating more sustainable fragrances with biotech

(Eurekalert)
In the face of a changing climate and crop diseases, manufacturers of products containing natural flavors and fragrances are pivoting to a new way to source ingredients. Companies have been partnering with biotechnology firms to manufacture scents and flavors using fermented microbes, which experts say are more sustainable. Although the availability of natural fragrances and flavors like citrus and vanilla is dwindling, the demand for them has increased. In recent years, flavor and fragrance companies have been working with the biotech industry to shore up supply chains and avoid issues like seasonality and poor harvests, without having to use synthetic compounds. Fermentation-derived ingredients can be listed as natural in the U.S. and Europe, which appeals greatly to consumers. Biotech firms and major chemical companies are stepping up their production of fermented products while also making the process more efficient and less expensive.

An Exclusive Interview with Dr. Govind Gujar, ex-Head of Division of Entomology, IARI

(Krishijagran)
Meeting future food needs without compromising environmental integrity is a central challenge for agriculture globally but especially for the Asia Pacific region – where 60% of the global population, including some of the world's poorest, live on only 30% of the land mass. To guarantee the food security of this and other regions, growers worldwide are rapidly adopting genetically modified (GM) crops as the forerunner to protect crops against many biotic and abiotic stresses, with 444 million acres produced globally in 2015. Asia Pacific countries play an important role in this, with India, China and Pakistan appearing in the top 10 countries with acreage of GM crops. This book is edited by Govind Gujar, ex-Head of Division of Entomology at IARI, New Delhi and Founder of Agribiosys; along with Y Andi Trisyono of the University of Gadjah Mada in Indonesia and Mao Chen of APAC Bayer Crop Science in Singapore.

EU's refusal to permit GMO crops led to millions of tonnes of additional CO2, scientists reveal

(Alliance for Science)
Europe's refusal to permit its farmers to cultivate genetically engineered (GE) crops led to the avoidable emission of millions of tonnes of climate-damaging carbon dioxide, a new scientific analysis reveals. The opportunity cost of the EU's refusal to allow cultivation of GE varieties of key crops currently totals 33 million tonnes of CO2 per year, the experts say. This is equivalent to 7.5 percent of greenhouse gas (GHG) emissions from the entire European agricultural sector, or roughly what might

be emitted each year by 10-20 coal-fired power stations. Given that farmers in North and South America adopted GE crops from the late 1990s onward, this analysis implies that over subsequent decades the additional carbon emitted due to the EU's opposition to genetic engineering will likely be in the hundreds of millions of tonnes.

New Research

Fields of Breeders' Dreams: Effort Toward Targeted Crop Improvements

(Seed World)

Identifying and breeding varieties that have high productivity across a range of environments is becoming increasingly important for food, fuel and other applications, and breeders aren't interested in waiting decades to develop new crops. One example is an ongoing collaborative effort to improve the emerging bioenergy crop switchgrass (Panicum virgatum), which has established 10 experimental gardens located in eight states spread across 1,100 miles. As reported in Nature, the team led by researchers at the University of Texas (UT) at Austin, the HudsonAlpha Institute for Biotechnology (HudsonAlpha), and the U.S. Department of Energy (DOE) Joint Genome Institute (JGI), a DOE Office of Science User Facility, has produced a high-quality reference sequence of the complex switchgrass genome using samples collected at these gardens. The switchgrass genotypes that were planted into the common gardens were sequenced and assembled by the JGI, allowing the research team to conduct association mapping, linking genes to traits. One of the team's findings is that the performance of switchgrass across the garden sites depended on the origin or collection location of the individual switchgrass plants. They were able to identify many regions in the switchgrass genome that are associated with genetic differences that lead to productivity in different environments.

Stacking five genes stomps pathogen

(The Western Producer)

The new strain has been named Big Five by the research team because it's the first-time breeders have successfully installed five stable genes in a strain of wheat to build resistance to (Puccinia graminis) stem rust resistant strain. But the breakthrough represents more than just a new working variety. It also introduces a whole new way to bring desirable traits into future wheat strains. Development of Big Five was partially funded by the 2Blades Foundation, a non-profit global plant research organization that regularly distributes their newly developed technologies at no cost to national and international agencies or even local seed companies. Wheat growers are well aware that the stem rust pathogen is capable of totally destroying a crop in a matter of weeks. The foundation says the new strain shows exceptional resistance to wheat stem rust. They emphasize that the most effective and environmentally benign way to control wheat rust is with genetic resistance, not chemicals.

With fertile land and water growing scarce, high-yield wheat and barley could help save millions from hunger

(GLP)

The big news, as reported in the journal Nature, is that researchers have sequenced new variations of 'genomes in barley and wheat. The international team includes scientists from the University of Adelaide's Waite Research Institute, along with the 10+ Genome Project, spearheaded by Curtis Pozniak, a professor at the University of Saskatchewan, Canada. Pozniak is in collaboration with the International Barley Pan Genome Sequencing Consortium, led by Nils Stein, professor at the Leibniz Institute of Plant Genetics and Crop Plant Research. What does that mean for society today? Because barley and wheat are staple crops on a global level, scientists may have found a way to produce the high yield necessary to feed more mouths within our lifetime. And it's not just a boon to cereal production; these discoveries bring us one step closer to unlocking the entire gene set, otherwise known as pan-genome, in wheat and barley, which has ramifications for all future research in plant genomics and cereal farming.

Kenya gears up for gene edited crops to boost food security

(Business Daily)

Sorghum, a drought-tolerant traditional crop, is quite an unlucky cereal. It is hard to digest and lacks taste; two undesirable qualities that have made it less popular among modern consumers. Even in

water stressed villages where the crop was once common for its resilience, farmers are slowly abandoning it because of its vulnerability to striga, a lethal plant weed. Professor Steven Runo, a molecular biologist and a genome editing researcher at Kenyatta University, is, however determined to make the grain popular again. The scientist who is currently developing a new sorghum variety that is more palatable, easily digestible and resistant to striga weed is using genome editing technology to do the job. Prof Runo points out that while sorghum has a high level of indigestibility and can give constipation, the traits can be eliminated through genome editing. In the past and even today, conventional breeding which also remains the most widely used approach in crop improvement would have been preferred, but researchers argue that it is labour intensive and takes several years to progress from screening of germplasms to commercial varieties. The International Maize and Wheat Improvement Centre (CIMMYT) for instance, developed some hybrid maize varieties that are resistant to the Maize Lethal Necrosis (MLN), but the process, according to them turned out to be quite resource-intensive and took close to five years

UCalgary scientists produce new canola type for potentially higher crop yield

(University of Calgary)

Canola is one of Canada's most important cash crops, but there's only so much suitable cropland where the plants can be grown. What if it were possible to modify the height and shape of canola, so more plants could be grown in the same amount of space — potentially increasing crop yield? In a new study, a team of biologists in the Faculty of Science at the University of Calgary used gene editing to modify canola's own genes, producing shorter plants with many more branches and flowers. "We showed that gene editing actually works in canola, and simultaneously improved agronomic traits in canola by changing the plant's architecture," says study co-author Dr. Marcus Samuel, PhD, professor and Director of Greenhouse Operations in the Department of Biological Sciences, whose research group did the study. "We were able to effectively induce such dramatic architectural changes in canola with one single gene," says study lead author Matija Stanic, who did the research for his master's degree. He is now doing a PhD, supported by a Max Planck Fellowship, at the University of Potsdam in Germany. The "green revolution" that began in the 1960s used plant-breeding techniques to produce elite lines of crop plants, including rice and wheat, which were shorter, more compact, and thus able to better utilize nutrients and other inputs. But little work had been done on canola.

Salt-tolerant, GM Eucalyptus tree has no adverse effects on biodiversity, study finds

(Springer)

An RNA chaperone gene derived from common ice plant (Mesembryanthemum crystallinum), alleviated injury and loss of biomass production by salt stress in Eucalyptus camaldulensis in a semi-confined screen house trial. In this study, we assessed the potential environmental impact of the transgenic Eucalyptus in a manner complying with Japanese biosafety regulatory framework required for getting permission for experimental confined field trials. Two kinds of bioassays for the effects of allelopathic activity on the growth of other plants, i.e., the sandwich assay and the succeeding crop assay, were performed for three transgenic lines and three non-transgenic lines. No significant differences were observed between transgenic and non-transgenic plants. No significant difference in the numbers of cultivable microorganisms analyzed by the spread plate method were observed among the six transgenic and non-transgenic lines. These results suggested that there is no significant difference in the potential impact on biodiversity between the transgenic McRBP-E. camaldulensis lines and their non-transgenic comparators.

Genome-editing tool TALEN outperforms CRISPR-Cas9 in tightly packed DNA

(Science Daily)

Researchers used single-molecule imaging to compare the genome-editing tools CRISPR-Cas9 and TALEN. Their experiments revealed that TALEN is up to five times more efficient than CRISPR-Cas9 in parts of the genome, called heterochromatin, that are densely packed. Fragile X syndrome, sickle cell anemia, beta-thalassemia and other diseases are the result of genetic defects in the heterochromatin. The study adds to the evidence that a broader selection of genome-editing tools is needed to target all parts of the genome, said Huimin Zhao, a professor of chemical and biomolecular engineering at the University of Illinois Urbana-Champaign who led the new research.

Nitrogen-efficient rice could preserve crop yields while cutting environmental impact of fertilizer

(ISAAA)

Scientists from the Institute of Genetics and Developmental Biology of the Chinese Academy of Sciences (CAS) have found a gene that plays an important role in helping rice adapt to low soil nitrogen. Nitrogen fertilizer has an indispensable role in increasing crop yields, but on the other hand, it creates a severe threat to ecosystems. For this reason, breeding new crop varieties with high nitrogen use efficiency (NUE) is a high priority for both agricultural production and environmental protection. Using a diversified rice population from different regions, the scientists carefully evaluated how various agronomic traits responded to nitrogen in fields with different nitrogen supply conditions. They further performed a genome-wide association study (GWAS), with one very significant GWAS signal identified. The detailed mechanisms of how OsTCP19 works in regulating rice tillering were also characterized. The researchers found that OsTCP19-H, the high NUE allele, was highly preserved in rice types grown in nitrogen-poor regions but has been lost in rice types grown in nitrogen-rich regions. They also found that OsTCP19-H is also highly prevalent in wild rice which was grown in natural soil without artificial fertilizer input and concludes that OsTCP19-H introgression into modern cultivars can improve nitrogen use efficiency 20-30% under conditions of decreased nitrogen supply.

***