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Pigeon pea is a key staple crop in India's rainfed agriculture and is the second important pulse crop next to chickpea. It is a rich source of protein and an integral part of the various agro ecologies of the country, is mainly intercropped with pulses, cereals, millets and oilseeds. Pigeon pea is a resilient food legume crop capable of alleviating malnutrition, improving soil conditions and livelihood of the smallholder farmers, especially in Asia and Africa.

Looking at the importance of the crop, International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), Patancheru, India has been doing several studies on this crop for many years now. Recently, they collaborated with Vienna Metabolomics Center at University of Vienna to improve the yields of pigeon pea. The study has been spearheaded by Dr Rajeev Varshney, Director for the Genetic Gains Research Program at ICRISAT and Professor Wolfram Weckwerth, Director, Vienna Metabolomics Center at University of Vienna.

From the study, researchers have identified how temperature controls male fertility in some lines of pigeon pea. They have also shown that sterility can be reversed with auxin treatment. The new findings are expected to pave way for techniques that can reduce the cost and effort in hybridizing the crop, and lead to increased yields.

The authors demonstrated that pigeon pea lines turning fertile in response to the environment, called Environment Sensitive Genic Sterile (EGMS) lines, can go from being male sterile to male fertile if the temperature of the growing environment is reduced to 24 degree Celsius. The Male sterile condition can be reversed by reducing the day temperature below the critical threshold temperature of 24 degree Celsius during the tetrad and microspore stage of pollen development. After determining the threshold temperature, the team worked backwards from protein expression to the metabolic pathway and then onto the gene expression to understand the molecular basis of sterility transition. They zeroed in on a key protein – a transcription factor. Transcription factors are known to play an important role in DNA transcription in the larger process of protein synthesis. The transcription factor called REVEILLE 1 regulates auxin levels, which explains fertility transition in response to day temperature, especially morning hours.

The study done by ICRISAT on EGMS pigeon pea line for many years was culminated in this study. Along with it, with precise temperature control one can now produce hybrid seeds for farmers and multiply the hybrid itself. And in environments where day temperatures do not favourably fluctuate, auxins can be used to achieve sterility to fertility transition. The researchers now look forward to seeing the study's results reach farmers' field.

The detailed study is mentioned in the research section of this newsletter. We have also captured interesting developments and research work from around the world in the agri industry. We hope you find it a good read.

Shivendra Bajaj
Executive Director
Federation of Seed Industry of India-Alliance for Agri innovation

AgBiotech News

Food Security: Scientist urges govt. to domesticate global technologies

(The Sun)

Nigeria has been advised to create necessary incentives that would encourage use of foreign technologies for improved crop yield that would ensure food security in the country. Dr Rose Gidado, Scientist at Open Forum on Agricultural Biotechnology (OFAB) Nigeria chapter, gave the advice. Gidado said this would avert disruptions to production and marketing systems, which often enhanced the resilience of farmers, while also cushioning the hardships experienced by vulnerable persons. She noted that at this critical stage in Nigeria's history, food was paramount and should be sourced from all available channels. For a nation to build, to become a developed nation, it should be able to feed its population, but we are still not able to do that. It is better we adopt appropriate technologies and localise them for use to develop our indigenous crops.

Viewpoint: Why the world needs GMOs—4 farmers make the case for biotech crops

(GLP)

The true experts in food production are farmers, the people who grow the crops and raise the animals we all rely on for sustenance. But for many years, the public conversation about agriculture and biotechnology has been dominated by other voices, namely environmental activist groups with a deep-seated scepticism of genetic engineering. While texting on their state-of-the-art iPhones, activists at non-profits such as Greenpeace and Organic Consumers Association take it upon themselves to urge farmers to embrace 100-year-old techniques that can't possibly produce enough food to feed the billions of people who need to eat.

Shetkari Sanghatana gives out seeds to conduct trials of GM brinjal in Maharashtra

(The Financial Express)

Maharashtra farmers' body Shetkari Sanghatana announced that it had begun an agitation so that farmers could sow genetically modified (GM) seeds in various parts of Maharashtra. The Sanghatana has also announced that it has distributed seeds of GM brinjal among farmers in Akola. Lalit Bahal, farmer and activist of the Sanghatana, in a small ceremony at Kovad village of taluka Tehnara in Akola district distributed the seeds of GM brinjal among 25-30 farmers. Sanghatana chief Anil Ghanwat said more such seeds will be given out to ones who will openly defy the law and plant the banned varieties of HTBt cotton, maize, soyabean and brinjal in their fields. Farmers shall conduct trials if the government is not willing to do it, he said.

Agriculture sector needs to increase private investment: Tomar

(Outlook India)

Union Minister of Agriculture & Farmers Welfare Narendra Singh Tomar has stressed on the need of increasing private investment in agriculture sector for propelling growth. He also called upon scientists to contribute in increasing agricultural production and mitigate difficulties. He further said that bio-fortification strategy must also be used to develop high quality crop varieties having high protein, iron, zinc etc. nutritional content. For this, plant breeders have to use latest biotechnology methods in addition to traditional methods of farming.

How GMO, gene-edited crops can keep cancer-causing heavy metals out of staple foods
(GLP)
One of the most pressing issues in public health is the presence of toxic elements in food, which potentially risk the health of millions of people. The presence of toxic elements like arsenic, cadmium, lead and mercury especially in rice and rice-based food products is a serious concern, which requires urgent public policy attention. Arsenic, a class I human carcinogen, is found in substantial amounts in rice grown in South East Asian countries like India, Bangladesh, parts of China and The United States. A recent investigation of baby foods from major manufacturers in The United States found that 95% contained lead, 73% contained arsenic, 75% contained cadmium and 32% contained mercury. About 25% of food tested contained all four toxic elements, though at levels that are unlikely to pose a risk to human health.

Transgenic crop introduction in Ethiopia sparks media debate
(New Business Ethiopia)
The introduction of transgenic or Genetically Modified crops in Ethiopia has sparked a heated media debate. The debates ignited due to the approval of genetically modified cotton plantation by the Ethiopian Ministry of Environment, Forest and Climate Change a year ago and the recent introduction/permission of maize and Enset (Ensete ventricosum/false banana) for Confined Field Trial (CFT) and contained laboratory research respectively. Agricultural Biotechnology Director of the Ethiopian Institute of Agricultural Research (EIAR) Tadesse Daba indicated that Bt-cotton was permitted for CFT in 2016 in Ethiopia and approved for plantation in 2018. According to Daba the introduction of Bt-cotton was initiated to alleviate the major cotton pest – bollworm (moth caterpillar that attacks the cotton boll) that highly affects the productivity of the agricultural product in Ethiopia which is endowed with favorable climate and agro-ecology for cotton.

British farmers need all the help science can offer. Time to allow gene editing
(The Guardian)
Is it important that we edit the genes of our crops? This answer is a definite “yes”. Agriculture faces huge challenges due to Covid-19, climate change and, for the UK, post-Brexit. Farmers have delivered admirably until now – there are more well-fed people on the planet than at any time in history – but, to help them meet the future challenges, they will need all of the help that science can offer. Gene editing is one powerful part of that help. An illustration of what we can do with gene editing is with ground cherry (Physalis pruinosa). Its small fruit taste like a cherry tomato injected with mango and pineapple and it could be one of our regular “five a day” because US scientists have developed a productive gene-edited variety. This pioneering example is with an unusual plant but it is important because it shows how gene editing can accelerate the improvement of other orphan crops like cassava, millet, cowpea and yams. These plants are staple food in many parts of the world but, unlike maize, rice, wheat and soybean, they have not benefited from years of intensive breeding.

Top 5 Biotech Crops Occupy 99% of Global Biotech Crop Area
(ISAAA)
In 2018, a total of 70 countries adopted biotech crops — 26 countries planted and 44 additional countries imported. Of the 31 crops approved for food, feed, and environmental release recorded at the ISAAA GM Approval Database, 13 crops have been planted in 26 countries in 2018. Five biotech crops planted in these countries occupy 99% of the global biotech crop area. The five major biotech crops planted at more than 1 million hectares are soybeans (95.9 million hectares), followed by maize (58.9 million hectares), cotton (24.9 million hectares), canola (10.1 million hectares), and alfalfa (1.2 million hectares).

92% Cotton, 90% Corn Areas in the US Produced with GE Seeds

(ISAAA)
Insect resistant crops that contain genes from the soil bacterium Bacillus thuringiensis (Bt) and produce insecticidal proteins have been available for corn and cotton since 1996. The area planted to Bt corn increased from 8% in 1997 to 19% in 2000, before climbing to 83% in 2019. Bt cotton area also expanded, from 15% of U.S. cotton planted area in 1997 to 37% in 2001. Currently, 92% percent of U.S. cotton is planted with genetically engineered, insect-resistant seeds.

After Bt cotton nod, Kenya sets sights on biotech food crops

(Business Daily)
Earlier in April this year the Ministry of Agriculture distributed one metric tonne of Bt cotton seeds for planting on demonstration plots covering 10,000 hectares to pilot and raise awareness on the transgenic cotton varieties. The cotton variety, according to biotech scientists, is high yielding and resistant to notorious bollworm insects and could therefore turn around the country's textile industry that has been on its death bed since early 1990's. By making the bold move, Kenya not only became the first East African country to ever adopt a transgenic cotton crop, but could also become the first in the region to grow genetically engineered food crops –if it approves Bt Cassava and Bt Maize whose research are currently at advanced stages. Bacillus thuringiensis or simply Bt is a beneficial and naturally occurring bacteria in the soil that has successfully been used over the years in biochemical pesticides to control vegetable caterpillars. But after scientists later discovered that adding Bt genes to conventional crops could effectively protect them against pest infestations and eliminate the use of pesticides, this form of genetically engineering of crops has since become the most widely used.

Ghanaian chief calls for commercialization of GMOs

(Alliance for Science)
A Ghanaian chief, Nana Adjie Panin II, has called for the country's commercialization of genetically modified (GM) seeds. Genetically modified organisms (GMOs) would be a panacea to the existing negative agricultural practices around the globe, according to the chief, who lives in Deduako, a farming community in the Ashanti region of Ghana. His assertions are based on his observations that chemical usage associated with agriculture is having a grave toll on the environment, human health and soil nutrients, and GM crops could reduce that impact. The chief, who is also a peasant farmer, made his remarks to members of the Ghana Agricultural and Rural Development Journalists Association (GARDJA) during their recent visit to his five-acre conventional farm at Deduako. He grows a variety of crops, including yam, plantain, cocoyam, cassava and cocoa. Despite the controversy around GMOs in the country, he said this appropriate technology should be adopted with no shred of doubt since it can stand the test of time.

Centre releases guidelines for evaluation of nano-based agri-input, food products in India

(Outlook)
The Centre released guidelines for evaluation of nano-based agri-input and food products in the country. The guidelines have been prepared jointly by Department of Biotechnology (DBT), Ministry of Science and Technology, Ministry of Agriculture and Farmers' Welfare, Food Safety and Standards Authority of India (FSSAI), Ministry of Health and Family Welfare through concerted inter-ministerial efforts coordinated by the DBT. These guidelines are aimed at assisting in making policy decisions by providing information on the existing regulations for nano-based products in agriculture and food and also to ensure quality, safety and efficacy of the targeted products.

How Gene Editing is Changing the Future of Wine—and Making it Less Likely to Give You a Hangover

(Mental Floss)
Introducing a new gene into an existing grape merely changes its traits while the variety of wine remains the same. This process can greatly assist marketing efforts in an industry where sales are mainly dependent on variety, even more so than quality. Given the industry's devotion to tradition, it can also make the idea of genetic modification an easier sell to vintners and cultivators. Gene editing technology has already shown a lot of promise in a number of isolated studies involving wine grapes. In the most recent example, Rutgers University researchers successfully used the CRISPR/Cas9 technique in 2019 to develop downy mildew resistance in Chardonnay. They isolated three genes that invite downy mildew outbreaks in wine grapes and successfully edited them to create a disease-resistant version of the crop.

African women are leading biotechnology's advance across the continent

(Alliance for Science)

Women researchers are strongly influencing the adoption of agricultural biotechnology in Africa. Dr. Felister Makini, deputy director general in charge of crops at the Kenya Agricultural and Livestock Research Organization (KALRO) said that as African women, we are the ones who suffer most whenever drought and food shortages strike, despite the availability of technological solutions to these problems. Throughout Africa, women are in labs developing crops that produce high yields and can tolerate or resist disease, as well as healthier, more productive livestock. They are also found in meeting rooms and gardens informing the public about their innovations and how these improved crops can aid the fight against hunger across both the continent and the globe. It is time to tell the public about the positive side of biotechnology.

Research

The mystery of pollen sterility and its reversion in pigeon pea revealed in a new study

(Phys.org)

Researchers have identified how temperature controls male fertility in some lines of pigeon pea and have unravelled the phenomenon's molecular mechanism in a recently published study in The Plant Genome. They have also shown that sterility can be reversed with auxin treatment. The new findings are expected to pave way for techniques that can reduce the cost and effort in hybridizing the crop, and lead to increased yields. Pigeon pea is extensively grown and consumed in South Asia and Eastern Africa, being one of the oldest food crops and a staple source of protein.

Roadmap laid out for next generation of crops for high productivity and resilience to climate change

(The University of Newcastle)

A roadmap to engineer or breed the next generation of crops for high productivity and resilience to climate change has been laid out by a team of world experts. The scientists, including Professor Yong-Ling Ruan from the University of Newcastle, have published findings and insights that identify key biological bottlenecks that limit plant productivity and therefore crop yields. The research, published in Nature Plants, critically analysed existing information, including the authors' own research, and found what the team believe to be crucial information for the future of agriculture production. Professor Ruan said that as agriculture faced a massive increase in demand given the dual pressures of a booming population and environmental deterioration, it was essential to understand the biological processes that regulate resource and energy distribution in the plant body, thereby allowing the identification of key gene targets for genetic engineering and breeding.

Growing seasons are less predictable. These scientists are taking a novel approach to boosting crop resilience

(GreenBiz)

To breed more resilient plants, Mackenzie tricks a plant into responding as though it is under stress so it will turn on its survival mechanisms. Mackenzie's "trick" is to use RNA interference to silence a gene called MSH1, found in the plant cell's plastid — a compartment that has the ability to sense stress. She and her colleagues discovered that when they suppress MSH1 in a parent plant, epigenetic regulation kicks in, and gene expression is altered in a way that allows it to better respond to stress. The research team found that the offspring of this parent plant inherit memory of this "stress": They, too, had altered gene expression, even without the artificial stress. Tomatoes treated in this way grew better and were more resilient to the heat of Florida field conditions — with up to a 35 percent boost in yield compared with an heirloom tomato variety.

A novel approach to realize DNA-free gene editing in plants

(Mirage)

The research team headed by Prof. LI Zhenghe from the Zhejiang University College of Agriculture and Biotechnology reported the engineering of a plant negative-strand RNA virus-based vector for DNA-free in plant delivery of the entire CRISPR-Cas9 cassette to achieve single, multiplex mutagenesis and chromosome deletions at high frequency in a model allotetraploid tobacco host. In this study, over 90% of plants regenerated from virus-infected tissues without selection contained targeted

mutations, among which up to 57% carried tetra-allelic, inheritable mutations. The viral vector remained stable even after mechanical transmission and could readily be eliminated from mutated plants during regeneration or after seed setting. This study provides a convenient, highly efficient and cost-effective avenue for CRISPR-Cas9 gene editing in plants through virus infection, thereby open the door to DNA-free plant genome editing.

New Highly Productive Sorghum Varieties Released
(ICRISAT)
Three improved sorghum varieties with a yield potential of approximately 4 tons per hectare and tolerant to grey leaf spot, rust and other common diseases were released in Malawi early this year. These new varieties replace two varieties released in 1993 and have since been the only improved sorghum varieties available in Malawi. ICRISAT Country Representative for Malawi, Dr Patrick Okori, said that ICRISAT and government are keen to replace the old varieties because they no longer meet today's production needs, leading to a significant decline in yield from three tons per hectare, at the time of release to an average of two tons per hectare, today.

Scientists create genetically modified plant as alternative to fish oils
(Irish News)
Scientists have created a genetically modified seed oil plant that could act as an alternative source to dwindling fish stocks for omega-3 fats. Oily fish such as salmon, mackerel and sardines are a common source for omega-3 fats – eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA) – which are important for normal health and development. a vegetable oil that contains EPA and DHA in similar amounts to fish oil has been developed by a team at Rothamsted Research and validated by the University of Southampton. Their study, published in the British Journal of Nutrition, shows no difference in the uptake of EPA and DHA among young and middle-aged people between the oil from the seed oil plant (Camelina sativa) or from fish oil.

CRISPR enables one-step hybrid seed production in crops
(Eurekalert)
Crop hybrid technologies have contributed to the significant yield improvement worldwide in the past decades. However, designing and maintaining a hybrid production line has always been complex and laborious. Now, researchers in China have developed a new system combining CRISPR-mediated genome editing with other approaches that could produce better seeds compared with conventional hybrid methods and shorten the production timeline by 5 to 10 years.

CRISPR enaPlant tissue engineering improves drought and salinity tolerancebles one-step hybrid seed production in crops
(Nevada Today)
After several years of experimentation, scientists have engineered thale cress, or Arabidopsis thaliana, to behave like a succulent, improving water-use efficiency, salinity tolerance and reducing the effects of drought. The tissue succulence engineering method devised for this small flowering plant can be used in other plants to improve drought and salinity tolerance with the goal of moving this approach into food and bioenergy crops. Water-storing tissue is one of the most successful adaptations in plants that enables them to survive long periods of drought. This anatomical trait will become more important as global temperatures rise, increasing the magnitude and duration of drought events during the 21st century.

Video by CropLife International and The American Seed Trade Association

CropLife International and The American Seed Trade Association have teamed up to profile some important research on the cassava plant by scientists at the Innovative Genomic Institute at UC Berkeley. The researchers are using CRISPR-Cas9 editing to try to reduce the natural cyanide content in this staple food for 800 million people around the world. This will help smallholder farmers and help to fight food insecurity in some of the world's most impoverished nations.
Watch the new video to learn more - https://www.youtube.com/watch?v=VIbtyyh22S8

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