Chickpea is a rich source of fibre, vitamin, mineral and protein and is an important crop for global nutrition and food security. India is the largest produce and consumer of chickpea and the production capacity has increased from 3.86 to 11.23 million tonnes between 2000–2001 to 2017–2018. However, the production still needs to ramp up to feed the growing population, with drought too impacting the yield.

To improve the production, a group of researchers across several research institutions in India are working to develop high yielding chickpea varieties. The team led by Dr Rajeev Varshney of ICRISAT recently reported their results in The Plant Genome. The researchers bred new varieties of chickpeas with drought tolerance and higher yields. Genetic techniques were used to breed several traits for drought tolerance. Popular chickpea varieties were chosen that were already grown by farmers.

The team used a common method called introgression, where a popular variety is crossed with a variety with the desired traits. Following a series of evaluations and repeated crossings, the breeders arrived at an improved chickpea variety with the desired traits. Since this conventional process needs screening of large number of plants in field condition, the researchers used a technique called marker-assisted backcrossing. It uses laboratory techniques to detect a genetic marker. Genetic markers are DNA segments associated with certain plant characteristics or agronomic traits desired by farmers. Genetic markers makes the breeding process precise, fast, and cost-effective.

The research helped to incorporate drought tolerance into three popular varieties of chickpeas. Of the six lines of chickpea developed by the researchers, one line, Pusa Chickpea 10216, has been released for use by Indian farmers. The work is a testimony of how genomics research can be used to develop better high-yielding drought tolerant varieties

We have also covered news around several important developments on agriculture across India, globally and in the area of research. We hope you find the newsletter a good read!

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

News from India and Around the World

SNP hints at softened stance on gene editing

(Farmers Weekly)

The Scottish National Party (SNP) has left the door open to changing its opposition to gene-editing technology if the party gains a majority in the upcoming Scottish parliamentary elections. Speaking at an NFU Scotland virtual hustings event, Fergus Ewing – who is bidding for re-election as a member of the Scottish parliament (MSP) and to continue his role as rural economy secretary – suggested a softening in his party's stance against the technology. During a question-and-answer session, Mr Ewing and fellow prospective MSP hopefuls were asked to clarify their party's stance on gene editing.

The world is dry and hungry but GM crops could change all that

(Business Day)

A world without enough food is just around the corner and can only be averted if humans forget their qualms about eating genetically modified (GM) crops, also known as biotech foods. Bioceres is trying to succeed where no other company has before by selling genetically modified wheat. While the vast majority of the world's soybean and corn crops are already GM organisms (GMOs), these are fed to livestock. Biotech wheat, on the other hand, would be directly eaten by humans in bread and pasta, something consumers and regulators have roundly rejected in the past. Now, only Argentina, where Bioceres is based, has ever approved a GM wheat.

Breeding a better chickpea

(News Wise)

A group of researchers across several research institutions in India are working to develop high yielding chickpea varieties. "High yielding varieties will help small-holder farmers by delivering more produce with an option to increase income," says Rajeev Varshney, member of the Crop Science Society of America. "It is important to develop better varieties that are tolerant to drought and are able to meet the demand." Over time, chickpea production has moved from northern India to the central and southern parts of the country, where there is less water. This is in addition to climate change impacting global agriculture.

Kenyan farmers reap bountiful first harvest of GM cotton

(Alliance for Science)

Winfred Kasambu, a 50-year-old farmer and a grandmother of two from Kenya's Eastern region, is cherishing high hopes of prosperity after realizing a bountiful harvest from her first crop of genetically modified Bt cotton. Kasambu is one of the 1,000 farmers selected by the Kenyan government in March 2020 to receive the country's first genetically modified (GM) insect-resistant cotton seeds. "With Bt cotton, I have reduced the use of chemical sprays since I have only sprayed them three times while

for the local [conventional] variety, I have so far sprayed six times and it still has a lot of pests. Caterpillar is a major challenge," Kasambu lamented.

Joanne Chory is using plants to save planet
(Washington Post)
The world was running out of time, and so was Joanne Chory. The 63-year-old biologist was nearing the end of a distinguished career researching how plants grow. Now she'd won the most prestigious honor in her field, the Breakthrough Foundation's life sciences prize, which came with a $3 million check and an opportunity to address inventors and well-heeled donors at a glitzy Silicon Valley awards ceremony in December 2017. In time, her speech would get the attention of foundations and pull in millions of dollars in funding, enabling Chory and her colleagues at the Salk Institute for Biological Studies in La Jolla, Calif., to expand their lab and enhance their experiments. They would identify the genes that make plant roots deep and thick and rich in sugar. Their greenhouses and growth chambers would be crowded with seedlings, and their project would be heralded as a revolutionary solution to the biggest problem on the planet.

National College, NRCB sign MoU
(The Hindu)
National College has signed a Memorandum of Understanding (MoU) with ICAR-National Resource Centre for Banana for collaborative research and internship of Biotechnology and Microbiology students. The MoU envisages deriving the utility of the facilities at ICAR-NRCB, the only research centre dedicated for banana in the country, with a field gene bank consisting of 373 banana germplasms, well-equipped research laboratories for genetic resources management, crop improvement, molecular biology, virology and biotechnology.

GM food can and must be labelled
(Euractiv)
A recent EU-wide opinion poll commissioned by the Greens/EFA Group in the European Parliament shows that the vast majority (86%) of Europeans who have heard of genetically modified (GM) crops want food produced from these plants to be labelled as such. The majority (68%) of respondents who have heard of new GM techniques, such as CRISPR, want food produced with these techniques also labelled as GM. The poll confirms the Commission's view that Europeans want detailed information about the food they buy, be it on the nutritional quality or the place and method of production. The Commission has announced mandatory, front-of-pack nutritional information and said it would develop a "sustainable food-labelling framework" that also covers the environmental and social aspects of food production.

"Historic fears" will put food supply at risk, say researchers
(New Food Magazine)
Global uptake of biotechnologies which could improve crop production has come to a halt, which an international team of researchers warns will place worldwide food security at risk. The group, led by the University of Birmingham, is calling on governments across the globe to implement policies that will drive progress in this field. In a recent article, the group raised social acceptance of technologies, such as gene editing, as a major hurdle to adoption. These "historic fears" and "misconceptions", as Professor Christine Foyer from the School of Biosciences at the University of Birmingham described them are, she claimed, stalling progress. This is a topic which New Food has discussed previously; the industry remains very much divided over whether such techniques can, indeed, over such advantages which this group suggests – including temperature resilient crops which would help reduce the risk climate change poses on our food supply.

Book review: Jennifer Thompson's 'GM Crops and the Global Divide' addresses Europe's neo-colonialist attempt to intimidate Africa into rejecting crop biotechnology
(GLP)
Jennifer Thomson's excellent new book, "GM Crops and the Global Divide" (CSIRO Publishing, 2020), is a highly informed, lucid, and gracious narrative. Able to maintain equanimity in the face of one of the most polemical debates of our time, Thomson, Emeritus Professor of Microbiology at the

University of Cape Town, provides a succinct yet detailed overview of the history of genetically modified crops, guiding the reader through the history of molecular genetic engineering, from its beginnings in the 1970s, and concluding with the birth of genome editing. A veteran in the field, she discusses the science and economics of GM crops from the viewpoint of many of the usual-suspect countries, including the United States, Brazil, India, and China, as well as an assortment of African nations. Thomson also manages to cover fairly and clearly many controversial topics such as Seralini's infamous fraudulent rat study, the continuing glyphosate saga, conundrums regarding food labelling, the myth of GM-caused farmer suicides in India, and misinformation in general, in a way that is informative but not inflammatory.

Why GM crops are good for you
(Mint)
If you have a problem with genetically modified (GM) crops, I have some bad news for you. The wild version of the grasses from which rice and wheat originated had an evolutionary trick that made the stem brittle just around the time the grain ripened, allowing the plant to shatter easily, causing the seeds to be dispersed more effectively by the wind. But some humans happened to notice that a few of these wild grasses had hard stems that did not shatter in the wind, and that let them collect these grains for their own consumption rather than let the plant pursue its better interest of dispersing its seeds far and wide. In fact, if these humans hadn't noticed these chance mutant varieties that had hard stems and selected them for cultivation, those plants would not have survived by themselves in the wild.

Way forward for TELA maize as confined field trial ends
(The Nation)
As Nigeria joins six other African countries including Kenya, Uganda, Tanzania, Ethiopia, Mozambique and South Africa, where the TELA maize is currently being developed to improve farmer's production on the continent, the country hopes to bridge the maize deficit so as to meet up local demand. The TELA Maize Project is a public-private partnership led by the African Agricultural Technology Foundation (AATF) working towards initiating commercialisation of transgenic drought-tolerant and insect-protected maize varieties to enhance food security in Sub-Saharan Africa. While the transgenic crop developed to resist Fall Army Worm (FAW) and drought has gone through three experiments of Confined Field Trials (CFT) at the research farm of Institute for Agricultural Research (IAR), Zaria, it has recorded a huge success. This reporter, who was at the research farm of IAR at the harvest of the third trial of TELA maize, observed that the newly developed maize is resistant to drought and stem borer such as fall army worm which could cost 80 percent yield losses.

'Lose-lose situation': Facing unprofitable organic farming, Mexico cotton growers resort to illegally planting GMO seeds
(GLP)
Cotton producers in Mexico are using illegal seeds due to the government's ban on using transgenics and due to lack of inputs, organizations and experts said. In June 2020, the Ministry of the Environment, Semarnat decided not to give Mexico's National Service of Animal and Plant Health, Food Safety and Quality the go-ahead to grant import permits for transgenic seed from the US, a situation that does not seem to be reversing anytime soon despite calls from the sector. "Since last year we have not imported new generation seeds, so farmers buy seed in the United States directly and import it illegally, or 'overflow' the seed they harvest, which is a chemical process to remove the fiber and fluff that remains and they sow it again," said Raúl Treviño, president of the National Committee on Cotton Product System. Going back to planting conventional cotton is not profitable for producers or friendly to the environment, since the crop requires more applications of pesticides and herbicides, which implies an increase in production costs and greater environmental impact.

Gene editing: is it the future?
(Farming Life)
But like so many new breakthroughs in the field of genetics, it is a development that brings with it a wide range of views in terms of how it can be put to best use. Politics also plays a part in this regard. The authorities in London believe gene editing to be a force for good. Courtesy of his speech to this

year's Oxford Farming Conference Department of Food, Environment and Rural Affairs (DEFRA) secretary of state George Eustice made it clear that gene editing has the potential to unlock substantial benefits to nature, the environment while also helping farmers to produce healthier and more nutritious food. The Minister also used the occasion of his speech to launch a public consultation process on gene editing.

Mexican farmers resist government's attempt to ban GM cotton

(Alliance for Science)

Though genetically modified (GM) cotton has been safely cultivated in Mexico at a commercial scale more for than 20 years, the government is jeopardizing the future of the nation's textile industry by restricting new approvals of GM seeds. Cotton farmers are fighting back. They've started to organize and demand access to GM cotton seeds through the Comite Nacional Sistema Producto Algodon (National Committee on the Cotton Product System). The push-back began after the United States Department of Agriculture's Global Agricultural Information Network (USDA-GAIN) recently reported that SEMARNAT has not approved any GM cotton seed planting permits since 2019. The agency cited concerns about the possibility of GM varieties intermixing with traditional wild cotton populations found in the south of the country. However, these wild varieties are not found in the north, where the majority of commercial cotton is grown. The permit rejections have had significant ramifications for cotton planting in Mexico, as producers now can access only a few outdated GM seed varieties that are not compatible with all growing areas and result in poor yields and ineffective pest protection. This is creating a highly uncertain situation for the country's cotton farmers and textile producers.

CRISPR poised to deliver dramatic benefits in fighting hunger and disease in Africa

(GLP)

In Africa, hunger and starvation are rapidly accelerating. Economic issues and dramatic weather changes resulted in over 20% of the population experiencing long-term hunger. A company, Calyxt, became the first to commercially debut a CRISPR gene-edited food, a soybean oil that is healthier for the body. Calyno, as the oil is known, marks a critical phase in gene modification. The time has finally arrived where it is possible to make foods that not only have been genetically altered to improve crop yield but food that is both tastier and healthier than standard crops. Other genetically modified crops were made more accessible through CRISPR, such as rice and other grains that are more resistant to pesticides and insects.

New Research

Chronoculture, harnessing the circadian clock to improve crop yield and sustainability

(Science Mag)

Circadian timing in plants is controlled by circadian oscillators in every cell. These oscillators contain pathways of regulation with high degrees of feedback between transcriptional regulators that are expressed in a temporal series through the day and night cycle. The genetic architecture of these circadian oscillators has been largely solved in plants, animals, and fungi during the last quarter-century. This has revealed a plant-specific set of circadian oscillator genes that are common between the major crops. Genome sequencing of crop plants and genetic mapping studies have demonstrated that agricultural breeding has selected for allelic variants in circadian genes, particularly for agricultural modification of the time to flowering. At the same time, indoor crop growth in controlled environments has expanded opportunities to improve agriculture by simultaneously engineering the external environmental cycles and the internal circadian cycles of crops. This knowledge of the genetic structure of the circadian system; the discoveries that the plant circadian oscillators regulate a swathe of plant physiology, metabolism, and gene expression; and improved genetic tools mean that it is now possible to consider translational research that aims to use the circadian system as an approach to improve crop yield and reduce inputs.

It turns out crops have been genetically modifying themselves for decades

(INews)

Wheat, rice, barley and other common crops routinely steal genes from neighbouring plant species to make them stronger, according to a new study that is likely to feed into the controversial debate about

genetically modified (GM) crops. Although 'lateral gene transfer' has been shown in fungi and algae before, this is the first time it has been demonstrated in 'grass' crops. These crops are able to bend the rules of evolution by borrowing genes from their surroundings to give them a competitive advantage.

Chinese hazelnut: The newest piece in the hazelnut genome puzzle

(Phys.org)

Hazelnut is an important commercial crop, being the fourth largest grown nut in the world. It is widely used for its oil content and pleasant flavor for the large-scale preparation of chocolates and cookies. Hazelnut oil has an important healthy fatty acid called oleic acid, which reduces the risk of cardiovascular diseases. Chinese hazelnut (Corylus mandshurica) has proven to be a useful species because of its high oil content and disease resistance traits. However, it lacks a high-quality genome and information about genes involved in traits like oil synthesis and stress resistance. A study published in Horticulture Research by a team of scientists from China led by Dr. Ying Li and Dr. Yong-Zhi Yang detailed a comprehensive and enhanced genome of the Chinese hazelnut. As Dr. Li explains, "If the genome of each species is a jigsaw puzzle, our study completed the puzzle of a hazelnut species with high quality and found several key pieces related to the quality of the hazelnut fruit." They identified 764 genes involved in oil biosynthesis, of which 96 are directly involved in oleic acid biosynthesis.

Gene Editing Solutions

(UDaily)

In states such as California and Florida, the $3 billion orange and citrus industry is big business. More than six in ten Americans drop oranges into their grocery carts. And when they peel that orange or drink a glass of juice, they want it to taste sweet. Enter citrus greening, a disease here to wreck your morning and the U.S. citrus industry's bottom line. Spread by the invasive Asian citrus psyllid insect, the disease now affects every citrus growing region in the country, costing growers $975 million annually. Once infected, a citrus tree produces small, bitter fruit, helps spread the disease and then dies prematurely. While the disease is an incredibly serious threat to growers, scientists hope to counterpunch using gene editing. This technological solution can be applied in multiple ways — for example, making citrus trees resistant to disease or reducing the viability of this invasive insect. While these technologies show promise, consumers will have to determine if the technologies are acceptable.

Native plants for greening Mediterranean agroecosystems

(Nature)

Australian researchers announced a new banana genetically modified to be resistant to TR4. The team managed to insert the gene that makes one of the wild banana varieties resistant into a commercial banana, and the researchers are now hoping to continue to boost the new banana's immunity using CRISPR. But how did the industry come to think of GM as its last and only hope? To answer that, we have to return to a different banana era. Nearly all of the bananas that are imported to the United States and Europe are "Cavendish" bananas, as has been the case for decades. But the Cavendish is not the thoroughbred of bananas; the fruit bruises easily, its per-plant yields are lower than other varieties, and it requires extensive agrochemical inputs to grow. Among cultures that entertain dozens of market banana varieties, such as India, Southeast Asia, and Central America, the Cavendish's popularity is low; it just simply doesn't taste as good as a banana can taste. However, the Cavendish has dominated in one important area: immunity.

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