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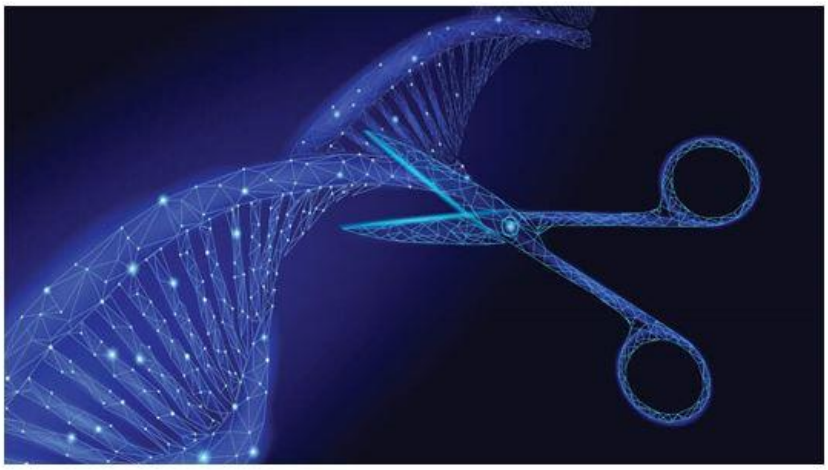

Stuart J. Smyth, a professor in the Department of Agricultural and Resource Economics writes in Genetic Literacy Project how Gene editing is like nature and why it should not be tightly regulated. Gene editing aids in improving a trait in plants precisely within a very short duration of time. Similar changes in plants occur naturally but it is impossible to regulate natural, random rates of genetic mutation. The beneficial mutation are passed along to future generations and can be increased over time, such as how plants develop natural resistance to specific insect pests naturally. Natural and random genomic mutations happen in all plant species from one generation to the next, all of which are completely unregulated with no risk assessments conducted. Therefore, the question remains that if naturally occurring mutations in plants are not regulated, is it right to regulate gene editing when it follows the same process?

Plants have natural ability to adapt to changing environment, it can take several years to make itself resistant to drought or disease or pest. Gene editing technology on the other hand simply speeds up what nature intends to do taking many generations. Risk assessment is designed to ensure that transformative changes in products don't provide a greater level of risk to humans or the environment than existing products. Based on the safe consumption of plants for thousands of years, humans have learned that mutation rates at this low level are safe.

Many countries such as USA, Brazil and Argentina acknowledged that a new plant variety is created through gene editing technologies that could have occurred naturally and that additional regulatory oversight isn't required. Regulations need to be risk appropriate, and should be applied when there has been a significant genomic change in a plant variety. Country such as EU have always maintained uncertainty and imposed strict regulations about all genomic technologies which has resulted in low research and development investments, reducing the region's ability to ensure crop yields are sustained as the climate changes.

Pressures by climate change is creating a crisis for sustaining food production to support the global population. We cannot rely on natural mutation to improve food varieties. Plant breeders have already assessed the looming crisis and therefore are demanding to ease regulation for gene editing globally.

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

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

News from India and Around the World

Why gene editing is so much like 'nature' — and therefore should not be tightly regulated

(GLP)

Plants have amazing abilities to adapt to changing environments, such as improved drought resistance, seed production and insect resistance. Genome editing technologies have the precision to simply speed up what nature has been doing for millennia. Risk assessment is designed to ensure that transformative changes in products don't provide a greater level of risk to humans or the environment than existing products. Slightly changing two to three genes out of several hundred thousand, isn't a transformative change. Based on the safe consumption of plants for tens of thousands of years, humans have learned that mutation rates at this low level are safe.

Nigeria urges Africa to follow its lead on GM cowpea

(Alliance for Science)

Nigeria is urging the rest of Africa to follow its lead and approve genetically modified cowpea to help ensure food and nutrition security on the continent. The Nigerian scientists and government officials who developed and approved the world's first genetically modified (GM) cowpea say their successful commercial release of the variety should give other African countries the confidence to do the same. The improved variety reduces pesticide use and increases yields by providing resistance to the destructive pod borer pest. "It is getting too late," said Prof. Mohammed Ishiyaku, executive director of Nigeria's Institute for Agricultural Research and principal investigator on the GM cowpea project. "It is high time for Ghana and other countries to hasten the processes to ensure these seeds get into the hands of farmers for them to be able to unlock the benefits in this new variety. It is highly beneficial not only in terms of productivity, but it reduces the use of harmful insecticides in our environment."

China publishes draft rules on herbicides for GM crops

(Reuters)

China published draft rules outlining registration requirements for herbicides used on genetically modified crops, in another sign that Beijing is gearing up to allow greater use of GM technology in agriculture. The rules include guidelines on efficacy trials for herbicides used on herbicide-tolerant corn and soybeans, according to the statement on the Ministry of Agriculture and Rural Affairs' website. China currently does not permit planting of any GM varieties of major feed or food crops, though most of its cotton is genetically modified. Last month it drafted new rules that lay out requirements for integrating a GM trait into conventional seed varieties, which was seen by the industry as a major step towards greenlighting commercial production of GM corn.

Gene Editing Revolutionizing Agriculture Through Improvement in Crops

(Krishi Jagran)

Over the past 50 years, as cultivable land shrank and prices rose, the demand for food has increased dramatically. Similarly, understanding the challenges of abiotic and biotic stresses, plant breeders have been constantly coming up with solutions to meet the demand by keeping food affordable for

people from all strata. The success of the Green Revolution was due to high rates of investment in crop research, infrastructure, and market development. It also largely benefited from appropriate policy support. Despite the success of the Green Revolution, investment in agriculture dropped off dramatically into the mid-2000s. But R&D remains an important aspect for sustaining agricultural productivity gains, enhancing competitiveness of smallholder farmers, and adaptability to climate change.

Healthcare to agriculture: How genome revolution could be game changer
(India Today)
In the present global context, it is increasingly important to recognise the critical impacts of climate change and the urgent need to increase nutrient-rich, sustainable food crop production in India. Targeted gene editing can allow us to improve key food crops by making them resistant to pests, droughts, and additionally enhancing their nutrient qualities. Gene-edited food crops could greatly help in increasing food production and improving crop varieties and thereby help achieve nutrition security for the country. This, obviously, need to be adopted under rigorous regulatory procedures to avoid any adverse developments that may not be beneficial to society.

CRISPR and the Climate
(Foreign Affairs)
CRISPR technology is not the same as GMO technology; it does not introduce DNA from other species into plants. Yet many governments remain largely opposed to using either GMO or CRISPR technology for crops, shrinking the toolbox for addressing climate change. Europe may pride itself on its climate change measures, but in agriculture, it is an example of what states shouldn't do. In 2018, the European Union's top court ruled that gene-edited crops were subject to the same stifling regulation that has largely kept GMOs out of European fields since the late 1990s. That means that instead of relying on modern technology, the EU's sustainable farming plan runs through its new Farm to Fork strategy, which will increase organic farming from nine percent to at least 25 percent of cropland in Europe.

Study backs adoption of GMO tech
(Bangkok Post)
Thailand needs a "new mindset" to adopt controversial genetically modified organism (GMO) technology to increase agricultural productivity and serve the bio-based petrochemical industry under the government's bio-, circular and green (BCG) economic model, a study says. The suggestion was presented by Khunying Thongtip Ratanarat, a member of the board of the Petroleum Institute of Thailand, who was asked by the Energy Policy and Planning Office to conduct a study on a master plan on the fourth-phase development of the Thai petrochemical industry over the next three decades. The new petrochemical industry should not only be driven by oil and gas but also bio-based industries which need the application of various agricultural products including cassava, sugar cane, rubber, and palm oil.

The Future of Plant Breeding in Africa: An Interview With Dr. Rita Mumm
(CSR Wire)
Plant breeding can help us adopt more climate-smart practices and address the needs of farmers – Genetic Modification (GM) and CRISPR are two DNA-based technologies that make this possible. GM or "genetically modified" traits have been developed in response to farmer needs for control of pests (like insects and weeds) and have become mainstream in crops like corn, soybeans, cotton, and canola. CRISPR can do even more, facilitating precise, directed genetic changes in a plant's genome. Traditional GM (genetically modified) traits have much higher costs during the initial scientific discovery phase, and additional costs associated with regulatory approval. Developing improved varieties with CRISPR is cheaper than relying on GM. That means that we can use CRISPR to develop foods that have a much smaller potential market, lowering the barriers to entry. This makes it possible for even small or non-profit organizations to develop new varieties to improve nutrition or farmers' income in small markets with unique sets of agronomic circumstances.

Climate-hardy gene-edited rice varieties are nearly ready for introduction — but EU Farm to Fork legislation might hold them back

(Infobae)

Scientists and the rice sector are ready to use the new gene editing tools to develop rice varieties more adapted to climate change, although they fear that European legislation will put a brake on transgenic rice. This has been expressed by more than a hundred international experts in rice genetics who have met in Barcelona (Spain) in the framework of the 18th International Symposium on Functional Rice Genomics.

Status of Gene Editing Use in Public Canadian Crop Breeding

(Centre for the study of Science and Innovation Policy)

In Spring 2021, Health Canada released proposed new guidance for the Novel Food Regulations, specifically focused on plant breeding, and conducted an open consultation seeking feedback from both industry stakeholders and general Canadian public. This move reflects the government's intent to establish a predictable commercialization pathway in preparation for new products that are developed using new plant breeding techniques, more specifically, "gene editing" (GEd) techniques. Crop breeders have been using genetic improvement technologies for decades, picking up tools that enhance their ability to effect change as they see a fit in their programme. Many tools have been developed to assist plant breeders in developing new cultivars that deliver higher yields, are more resistant to biotic and abiotic stresses, and are better adapted to changing environmental conditions. Most recently, the Clustered Regularly Interspaced Short Palindromic Repeats method (CRISPR/Cas9) of GEd has been touted to have great promise due to its immense versatility and the relative ease with which it can be used.

Scientists seize 'once in a decade' opportunity to advocate for genetically engineered trees

(Alliance for Science)

Nearly 700 scientists from across the globe have signed a petition urging the Forest Stewardship Council (FSC) to allow genetically engineered trees in the forests and products that it certifies. Though the FSC currently prohibits the use of genetically modified (GM) trees in its certified forests, it does allow field testing and some of its member companies are investing in biotechnology research. With the consultation request, it is now considering what role it should play in setting the conditions and safeguards for the commercial use of GM trees and whether it should engage in a trial project for the use of GM trees in forests that the FSC does not certify. "We have a once in a decade opportunity to influence decision makers at FSC and less than a decade to develop strategies to save our forests in many parts of the world," wrote Prof. Alexander Myburg, director of the Forest Molecular Genetics Program at the University of Pretoria, in a letter to his colleagues.

GMO crops have reduced pesticide poisoning among farmers, report finds

(GLP)

Many countries have enjoyed improved economies and healthier populations by farming genetically modified (GM) crops, according to a report from the United Kingdom.

A primary benefit has been a reduction in pesticide poisoning among farm workers, particularly smallholder farmers, due to the low pesticide use associated with GM crops, observes the Report on Genetic Technologies by the UK's Regulatory Horizons Council. In India, for instance, the report cites a 50-to-70 percent reduction in pesticide applications on insect-resistant GM (Bt) cotton, which has led to significant health benefits. "It has been estimated that this GM crop helps to avoid several million cases of pesticide poisoning per year," the report states. "There have also been significant economic and health benefits for small farmers growing cotton in South Africa." Pesticide poisoning is a persistent challenge dogging agricultural production in many parts of Africa. Despite glaring evidence of potential harm to human beings and the environment, commercial and political interests often encumber mitigation efforts. Shocking reports of pesticide poisoning keep emerging from the continent.

Realizing the Potential of CRISPR-Cas Technology To Mitigate Climate Change

(Technology Networks Genomics Research)

One of the biggest challenges facing humankind is how to feed an increasing world population while minimizing the impact on the environment. According to the United Nations, we may need to provide food for an additional 3 billion people by 2100. Current patterns of land use – including the destruction of forests and wetlands to increase agricultural production – contribute 23% of all greenhouse gas emissions caused by human activities, and at least a third of the annual global food production is wasted, including losses due to disease and insects. As the climate changes, we urgently need to engineer plants that can withstand harsher climatic conditions and exposure to new pests and diseases. Genome editing using CRISPR technology may be a key approach to improving agricultural production. It is already being used to increase the protein content of foods, enhance disease resistance and extend the shelf life of fruit and vegetables. It also has the potential to dramatically accelerate tree breeding programs and incorporate desired genetic alterations. Scientists are now using CRISPR to develop microbes that enhance the nutritional composition of the soil and change gas absorption and emissions so that certain cultures emit less methane or absorb more CO2. In parallel, CRISPR is also being used in basic research to build up libraries of plant mutations which may prove useful in the future.

No special skill to apply agri-biotech –Expert

(Sun News)

An expert in agri-biotech and the Country Coordinator, Open Forum on Agricultural Biotechnology (OFAB), Dr. Rose Gidado, has stated that Nigerian farmers need no special skill or training in order to benefit from agricultural biotechnology. Gidado, who is also the Deputy Director, National Biotechnology Development Agency (NABDA), said this recently while speaking on agricultural biotechnology in Abuja. She explained that, as end users of agricultural biotechnology products, farmers need no special training or skill to become beneficiaries of agricultural biotechnology, adding that these products comprise seeds and plantlets, which are the same as conventional products. The OFAB Coordinator, Nigerian chapter, noted that decades of documented evidence demonstrate that agricultural biotechnology is a safe and beneficial technology that could contribute to both environmental and economic sustainability.

Gains Foregone by Going GMO Free: Potential Impacts on Consumers, the Environment, and Agricultural Producers

(CAST)

Challenges associated with supplying society with food have evolved from additional innovation and continual innovation will be required to meet the needs of humanity. The ability of genetic improvement techniques, like genetically modified organisms (GMOs), to provide such innovation cannot be trivialized. More than a decade ago, Fedoroff and colleagues (2010) published a perspective in Science stating that our ability to adapt agriculture would partly depend on acceptance of genetic improvement techniques, like genetically modified organisms (GMOs). Two years ago, much less a decade ago, we could not imagine the impacts of a global pandemic that compounded the need for a resilient food system. Moreover, innovation in agricultural production is necessary to aid in combatting the negative effects of climate change and new pest and disease pressures that result from trade between geographical regions. Human behavior, and its influence on the climate, have caused a decrease in global agricultural efficiency by an estimated 21% since 1961 (Ortiz-Bobea et al. 2021). This is equivalent to losing seven years of production and future reductions in efficiency are anticipated to be greater for populations in warmer regions like Africa and Latin America. GMOs have the capability to increase nutrition security (De Moura 2016; Zimmermann and Qaim 2004), while also reducing land use (Brookes and Barfoot 2020a; Taheripour, Mahaffey, and Tyner 2016) and reliance on more toxic chemicals (Ahmed et al. 2021).

Nigerian GMO cowpea farmers testify to reduced pest infestation and better yields

(GLP)

Nigerian farmers growing the country's first GMO food crop — pod borer-resistant (PBR) cowpea, or beans — say they have seen less pest damage in their fields compared to when they grew conventional varieties. The farmers say the lessened insect pest pressure is giving them increased yields. They are also reporting higher profits because of the better yields and reduced investments in costly pesticides.

PBR cowpea has reduced pesticide use from eight sprays per season to just two. Dabo Umar, a 65-year-old farmer in Kano State with 20 children and two wives, told the Alliance for Science in an interview on his farm that he earned an estimated additional 20,000 Naira (US$50) profits from his 5 acres of PBR cowpea in 2020, compared to the season before. “This cowpea is better than any other cowpea,” said Dabo, who has 35 years of experience growing cowpea. “This is the best one… And many people are asking how we get this cowpea.. No Maruca (pod borer pests). We are very happy about that.”

Harnessing the Power of CRISPR to Reduce Poverty and Malnutrition

(Newswise)

A five-year partnership being launched by the Innovative Genomics Institute (IGI) — a non-profit founded by Nobel Laureate Jennifer Doudna — and CGIAR, the world’s largest publicly-funded agricultural research partnership, will harness the power of science to help millions of people overcome poverty, hunger, and malnutrition. One in four people globally, and rising, are unable to afford a healthy diet. COVID-19 has exacerbated this trend by disrupting food production and distribution, driving up by 20 percent the number of people threatened by hunger in 2020. The pandemic is unfolding amidst an environmental and climate crisis which is undermining food production and our ability to nourish the world. According to Barbara Wells, Global Director for Genetic Innovation at CGIAR: “World-class science is vital for facilitating farmer adaptation and mitigating our food system’s contribution to climate change. Plant-breeding innovations can help ramp up food production while making farms more climate resilient, profitable, and environmentally friendly”.

The Global GM Regulatory Landscape and How Gene Editing Fits In It (Part 1)

(ISAAA)

Genetically modified (GM) crops have been planted in different countries for 25 years. In an article written by Crystal Turnbull, Morten Lillemo and Trine A. K. Hvoslef-Eide of the Norwegian University of Life Sciences in early 2021, the regulatory approaches and systems of some of the top GM crop-producing countries as well as their experiences were documented and reviewed to come up with an overview of the global legislative landscape. The article highlights the individual country regulations and how gene editing, a newly emerging field of technology with tremendous potential benefits to farmers and consumers, fits in them.

New Research

Cheers! Better Beer From CRISPR Gene-Edited Barley

(Scitech Daily)

After a spell of unexpected rain, before the harvest season, a farmer may be faced with the unpredictable problem of untimely sprouting of barley. Sprouted barley fetches considerably lower market prices and poses an economic burden on farmers and corporations that are at the mercy of nature to survive in the agriculture industry. The aggravation of climate change has not made this situation any better either. The problem of pre-harvest sprouting, thus, has kept agricultural researchers occupied for a long time. Pre-harvest sprouting can be avoided by prolonged grain dormancy through genetic manipulation. However, such dormancy can interfere with malt production and can also cause non-uniform germination upon sowing. Balancing these issues is, therefore, necessary for high-quality barley production. Now, a team of scientists, led by Associate Professor Dr. Hiroshi Hisano from Okayama University, Japan, offer a solution to this age-old problem. To achieve the ‘perfect’ barley, they looked to the latest gene manipulation technology—CRISPR/Cas9-based gene editing. Speaking about their motivation to pursue the art of perfecting barley, Dr. Hisano says, “We recognized the need to strategically manipulate crops to weather the effects of steadily exacerbating climate change. Since our collaborative research group had already developed expertise in precision genome editing of barley, we decided to go with the same initially. Also, previous studies have pinpointed specific grain and seed dormancy genes in barley, called Qsd1, and Qsd2. Hence, our modus operandi was pretty clear.” Their findings have been published as a research article in Plant Biotechnology Journal.

Cacti and other succulents provide a genetic blueprint for scientists engineering climate-resilient crops

(AZcentral)

Geneticists have long tried to understand the biochemical marvel of the succulent, and there is still much they don't know. But these botanical curiosities have two important things in common. They're really good at storing water. And they work at night. Now, molecular biologist John Cushman and his team want to build off the lines of genetic code that give desert plants their superpowers. He wants to make soybeans behave a little more like succulents. Some researchers use DNA analysis to assist with selective breeding, honing in on desirable plant traits and creating better crop varieties in just a fraction of the time of traditional breeding methods. Others use newer technologies like CRISPR, commonly described as a pair of "genetic scissors," to snip out undesirable traits and replace them with better ones without using DNA from another plant and without the controversy associated with GMOs.

Japanese research team produces 30% sweeter tomato via gene-editing tech

(Hortidaily)

A tomato that is about 30% sweeter than usual has been produced using gene-editing technology, a Nagoya University research team announced. The team was led by Associate Professor Katsuhiro Shiratake, an expert on plant physiology, and the findings were published in the international science magazine Scientific Reports. Sweet tomatoes tend to be expensive due to low yields, and Shiratake believes such tomatoes will become more accessible to consumers because of the breakthrough. The team focused on modifying an invertase inhibitor, a gene involved in the process of sweetening tomatoes in which sugars produced through photosynthesis are carried from the plant's leaves to the fruit. By editing the gene, the team was able to culture tomatoes via conventional methods that resulted in fruit the same size as usual.

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