https://www.isaaa.org/kc/cropbiotechupdate/newsletter/default.asp?Date=8/4/2021

NEWS FROM AROUND THE WORLD

Study Documents 13 Years of Adoption and Learning by US Soybean Farmers

August 4, 2021

By analyzing how the evolution of learning affects technology adoption of genetically modified (GM) soybean seeds by farmers in the United States, scientists were able to conclude that uncertainty is considerably reduced over time thanks to increased learning efficiency.

The scientists examined farmers' adoption decisions in three stages: the early majority (1996-2001), the late majority (2001-2006), and the laggard stages (2006-2009). By using the "forward-looking" model, they were able to document that farmers were more likely to be forward-looking in the first 12 years of experimentation with the GM soybean technology. They also found that farmers learn both from their experiences and their neighbor's as well during these stages. However, learning was found to be complete during the laggard stage reducing uncertainty to a minimum from both sources. Therefore, learning efficiency for own- and neighbor's experience improves each year and decreases uncertainty about profitability of the GM soybean seeds over time.

The results of the study exhibited that farmers' learning evolves over time. These can guide policy makers or marketing firms in promoting new agricultural technologies, such as providing training and extension support when introducing new technology to farmers during the early stages of the technology, then focusing on subsidizing farmer adoption when the technology is in the market and adopted by a certain percentage of potential users.

To find out more, read the full paper in *bioRxiv*.

RESEARCH HIGHLIGHTS

Research Reveals Secrets of an "Immortal" Plant

August 4, 2021

Researchers from the Chinese Academy of Sciences and partners cracked the genetic secrets of Welwitschia, a two-leafed plant that thrives in the desert for over 1,000 years. The results of their findings are reported in *Nature Communications.*

"Most plants develop a leaf, and that's it," said Andrew Leitch, a plant geneticist at the Queen Mary University of London. "This plant can live thousands of years, and it never stops growing. When it does stop growing, it's dead."

The genomic studies revealed that the Welwitschia genome has been shaped by a lineage-specific ancient, whole-genome duplication that happened ~86 million years ago. Then, about 1-2 million years ago, extreme drought stress could have caused bursts of junk DNA activity. As a counterreaction, the Welwitschia genome went through massive epigenetic changes that silenced the junk DNA sequences through DNA methylation. These occurrences, together with other factors, led to a very efficient, low-cost genome of Welwitschia.

These findings on the Welwitschia genome could provide insights on how to breed better crop varieties that can withstand extreme abiotic stress.

Read the original article and the abstract for more details.

Study Explores Degradation of Cry Proteins After Harvest

August 4, 2021

University of Maryland researchers investigated how long Cry proteins persist in SmartStax corn when subjected to four post-harvest practices. The results are published in *Transgenic Research*.

Cry protein levels are expected to decline over time due to microbial decomposition and leaching. Thus, the researchers tracked how long biologically active Cry proteins last in SmartStax corn residue expressing Cry1A.105, Cry1F, Cry2Ab2, Cry3Bb1, and Cry34/35Ab1, when exposed to four post-harvest practices including chisel plow tillage, flail mowing, cover crop planting, and undisturbed residue.

Results showed that Cry proteins continued biological activity for as long as 24 weeks after harvest when residue was left above ground with less soil contact.

Read the research article in *Transgenic Research*.

PLANT BREEDING INNOVATIONS

Protocol Reveals How to Generate Clonal Seeds from Hybrid Rice with CRISPR-Cas9

August 4, 2021

Chinese Academy of Agricultural Sciences researchers outline the methods for generating clonal seeds from hybrid rice with CRISPR-Cas9 in the book titled *CRISPR-Cas Methods*.

The use of heterosis in rice production has significantly improved yield. However, hybrid vigor cannot be preserved in the offspring because of genetic segregation. Simultaneous editing of *REC8*, *PAIR1*, and *OSD1* genes turns meiosis into mitosis and eventually produces clonal gametes, while knockout of the *MTL* gene leads to maternal haploid seeds development. Genome editing of all these four genes in hybrid rice simultaneously could fix the heterozygosity and obtain clonal seeds from hybrid rice. The protocol provides a detailed technique for generating clonal seeds from hybrid rice by using the multiplex CRISPR-Cas9 technology.

Read the protocol in Springerlink.

https://www.isaaa.org/kc/cropbiotechupdate/newsletter/default.asp?Date=8/11/2021

NEWS FROM AROUND THE WORLD

Plant Biotech Needs Better Politics to Counter Critics, Encourage Innovation, Build Trust

August 11, 2021

Plant biotechnology needs better politics to counter well-organized campaigns by environmental groups, encourage innovation, and build public trust in the policies. This is according to Alan Raybould, a genetics expert from The University of Ediburgh. He mentioned this in his commentary published in *Transgenic Research*.

According to his article, environmental groups have prompted calls to remove politics in the regulatory governance of GM crops. However, regulatory systems are inevitably political because the role of the policies is to guide decisions on the use of GM products. He stressed that better politics starts with political leadership with a focus on attaining food security and other sustainable development goals. The other aspects of better politics mentioned include regulatory reform to set policy objectives and decision-making criteria that promote innovation as well as control risk and public engagement that tackles the values behind attitudes to the application of plant biotechnology.

Read the original article in *Transgenic Research*.

Study: GM Plant with Fish Genes to Monitor Harmful Chemicals in Rivers

August 11, 2021

Researchers at Kobe University, Japan, and Agrobioinstitute, Bulgaria, have developed a simple way to monitor endocrine disrupting chemicals (EDCs) in river water using genetically modified plants with genes from medaka fish. The results are published in *Chemosphere*.

GM Arabidopsis exposed to as little as 5 ng/mL of 4-t-octylphenol (OP), an example of an EDC, produced detectable levels of green fluorescent protein (GFP) in response to expression of medaka estrogen receptor genes. Though it is not a new method to insert animal genes into plants to copy a specific reaction to hazardous chemicals, it is the first time that fish genes have been used.

Tests of this method revealed that medaka plants were 1,000 times better at OP detection than the previous method that the team have developed. The medaka plants were also able to detect other EDCs such as the sex hormone 17β-oestradiol; pesticides imidacloprid and fipronil; and global pollutant perfluorooctane sulfonate.

Read the original article in Chemical Watch and the research article in the *Chemosphere*.

PLANT BREEDING INNOVATIONS

Simple Heat Treatment Boosts CRISPR Efficiency in Arabidopsis

August 11, 2021

Ehime University researchers reported a simple heat treatment that can increase CRISPR efficiency in Arabidopsis. Their findings are published in the *Plant and Cell Physiology* journal.
In editing the genome of Arabidopsis, the *SpCas9* and guide RNA genes are commonly introduced into the genome by the floral dip method. One of the advantages of this method is that genome-edited plants can be isolated effortlessly. However, mutation efficiency in Arabidopsis using *SpCas9* is not as high as that achieved in rice and tobacco, which are subjected to a tissue culture step.

The researchers compared four promoters and found that the parsley *UBIQITIN* promoter is significantly active in Arabidopsis meristem tissue. They also explored if a simple heat treatment could improve mutation efficiency in Arabidopsis. Results showed that just one heat treatment at 37 °C for 24 hours increased the mutation efficiency at all four target sites from 3% to 42%, 43% to 62%, 54% to 75%, and 89 to 91%, respectively, without detectable off-target mutations.

Based on the results, the researchers recommend heat treatment of plate-grown plants at 37 °C for 24 hours to increase the efficiency of CRISPR-Cas9-mediated mutagenesis in Arabidopsis.

Read the accepted manuscript in the *Plant and Cell Physiology* journal.

https://www.isaaa.org/kc/cropbiotechupdate/newsletter/default.asp?Date=8/18/2021

NEWS FROM AROUND THE WORLD

GMO Panel Finds GM Carnation Does Not Pose Risk To Health, Environment

August 18, 2021

After a careful evaluation of the genetically modified (GM) carnation SHD-27531-4, the Norwegian Scientific Committee for Food Safety Panel on Genetically Modified Organisms (VKM GMO Panel) concluded that the transgenic plant does not represent any environmental risk in Norway.

The GM carnation is a transgenic variety of *Dianthus caryophyllus* L. that is used as a decorative species. Its flowers' red-purple color is the result of the expression of the newly introduced genes dihydroflavonol 4reductase (DFR) enzymes, and flavonoid 3',5'-hydroxylase (f3'5'h). These enzymes enable the production of the anthocyanidins delphinidin and cyanidin in the petals. The GM carnation also contains a mutated herbicide tolerance gene from *Nicotiana tabacum*, coding for acetolactate synthase (ALS) variant protein to facilitate the selection of GM plantlets during the genetic transformation process. The plant underwent several generations of vegetative propagation and no observed changes in the introduced flower color trait was reported.

The findings of VKM GMO Panel are summarized as:

1. The reported morphological differences between SHD 27531-4 and the parent cultivar do not raise safety concerns;
2. DFR, f3'5'H, and ALS proteins and anthocyanidin pigments are unlikely to increase potential health risk compared to the non-GM counterpart; and
3. The GM carnation is intended as cut ornamental flowers and does not represent an environmental risk in Norway.

To learn more, read the full paper in the *European Journal of Nutrition and Food Safety*.

PLANT BREEDING INNOVATIONS

Researchers Present Prospects for Genome Editing of Potato

August 18, 2021

Transgenic technology and gene silencing offer new solutions to time-consuming conventional breeding programs applied to important crops including potato. Researchers Sona Dev, Jini Joseph, and Ligi D' Rosario presented the prospects for genome editing of potato in an open-access peer-reviewed chapter in IntechOpen.

According to the authors, genetically modified crops face regulatory hurdles and safety concerns. Thus, they suggest the use of genome editing techniques such as ZFNs (zinc-finger

nucleases), TALENs (transcription activator-like effector nucleases), and CRISPR-Cas9 (clustered regularly interspaced short palindromic repeats/CRISPR associated Cas9). These tools offer a better choice of production of transgene and marker-free disease resistant potatoes.

Read the details in IntechOpen.

https://www.isaaa.org/kc/cropbiotechupdate/newsletter/default.asp?Date=8/25/2021

NEWS FROM AROUND THE WORLD

India Eases Rules for Import of GM Soya Cake, Benefits Farmers

August 25, 2021

The Indian government has relaxed its rules for the importation of crushed and de-oiled GM soya cake for livestock feed, benefiting farmers, poultry farmers, and fishermen.

The Indian Directorate General of Foreign Trade (DGFT) released a notification that allows imports of 1.2 million metric tons of crushed and de-oiled GM soya cake (non-living organism only) under ITC HS

codes 23040020 and 23040030 from Nhava Sheva port and LCS Petrapole, until October 31, 2021, or until further orders, whichever is earlier.

The notification was released after the Ministry of Environment, Forest and Climate Change clarified and gave permission to implement the relaxed ruling. "Since soya de-oiled and crushed (DOC) cake does not contain any living modified organism, this Ministry has no concerns and no objection for import of soya cakes from an environmental angle," the Ministry announced. Strict monitoring will be implemented by the Central Board of Indirect Taxes and Customs.

According to South Asia Biotechnology Centre (SABC), the policy change has far-reaching implications in the approval of commercial cultivation of biotech traits in soybeans, maize, and cotton in India and import of by-products such as soy de-oiled cake, maize, and other biotech products.
Read the press release from the Press Information Bureau of the Government of India. Stay tuned to SABC for more updates on biotechnology in India.

European Commission Authorizes 10 GM Crops for Food and Feed

August 25, 2021

The European Commission has authorized seven genetically modified (GM) crops (3 maize, 2 soybeans, 1 oilseed rape, and 1 cotton) and renewed the authorizations for two maize and one oilseed rape used for food and animal feed. The announcement was made on the European Union's Daily News published on August 17, 2021.

All of the 10 GM crops have gone through a comprehensive and stringent authorization procedure, including a favorable scientific assessment conducted by the European Food Safety Authority (EFSA). The authorization decisions do not cover cultivation. Member States did not reach a qualified majority either in favor or against at the Standing Committee and at the subsequent Appeal Committee, therefore the European Commission has the legal duty to proceed in line with the scientific advice received. The authorizations are valid for 10 years, and any product produced from these GMOs will be subject to the EU's strict labeling and traceability rules.

For more details, read the Daily News in the European Commission Press Corner.

PLANT BREEDING INNOVATIONS

Coalition of NGOs Outline Principles for Responsible Governance of Gene Editing

August 25, 2021

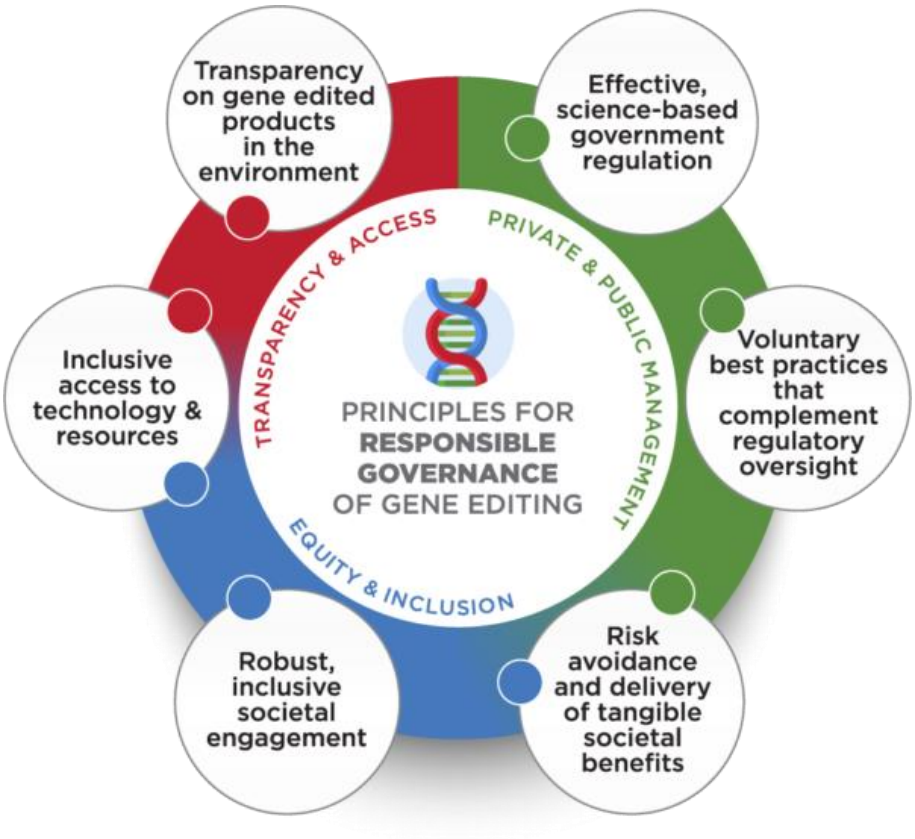

Photo Source: Keystone Policy Center

A coalition of conservation and consumer non-governmental organizations presented six principles for responsible governance in gene editing in agriculture and the environment in an article published in *Nature Biotechnology.*

According to the authors, gene editing, as well as other biotechnologies, have the potential to address urgent concerns on food security, environment, human health. However, conflicts and risks also arise. The coalition, which includes the Center for Science in the Public Interest, Consumer Federation of America, Environmental Defense Fund, Wildlife Federation, The Nature Conservancy, and World Wildlife Fund U.S., provided the principles as a high-level framework for responsible innovation and governance of gene-editing technologies.

The six principles presented were:

- Effective, science-based government regulation;
- Voluntary best practices that complement regulatory oversight;
- Risk avoidance and delivery of tangible societal benefits;
- Robust, inclusive societal engagement;
- Inclusive access to technology & resources; and
- Transparency on gene editing products in the environment.

"Our principles could apply to products produced with almost any technology...We have focused on genetic editing because: this methodology has potential for safe and beneficial applications; new products are being developed rapidly; regulation and introduction of new products into commerce is controversial; and the lack of appropriate governance could lead to unintended environmental consequences or severely limit its use," the authors wrote.

Read the principles in *Nature Biotechnology* or the media release in Keystone Policy Center.