

PAKISTAN BIOTECHNOLOGY INFORMATION CENTER

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Agriculture Plays Vital Role in Economy: Mohibullah

Khyber Pakhtunkhwa Minister for Agriculture and Livestock Mohibullah Khan has said that agriculture has an important role in national economy, crop production of the land owners and Foods needs of the province, so the agriculture sector cannot be neglected. He directed to ensure the provision of maximum facilities to the farmers so that their income can be increased substantially. He said On-farm water management plays an important role in preventing water wastage.

Addressing the closing ceremony of the training course for mango farm water management officers and engineers in Peshawar organized by Improvement Project, Director General on Farm Water Management Javed Iqbal Khattak and other relevant officers also spoke on this occasion.

In his speech, the minister Mohibullah Khan said that water, food security, climate change and other important projects are a good initiative of the current provincial government for the welfare of the people, which will benefit the farmers and the common people. He said that the annual budget of the Agriculture Department has been increased from 2 billion to 55 billion. While the budget will reach to 130 billion which is important for the development of agriculture.

Before the PTI government, money has not been spent on this important sector by any government.

He said that In-farm water management has an important role to reduce the wastage of water and provincial government is taking serious steps to save water because in the coming times there will be a major problem of water shortage all over the world.

Original Link: <https://pakobserver.net/agriculture-plays-vital-role-in-economy-mohibullah/>

Technology Gap in Agriculture

Agricultural productivity in the country has stagnated for want of optimum technology applications. Most commentators tend to blame the academia and the research community for this. Admittedly, there are several research gaps but even more pronounced is a lack of skill, innovation and adoption. There are many ways to look at the challenge land and water development farm machinery and precision seed and agro-chemicals farm services and credit processing and value addition markets and agribusiness rural-urban transition and public policy and governance etc.

Machine operations require economies of scale, which are often beyond the means of most small farmers. Absorption of scale-neutral technology seed, fertilizer, animal feed, and chemicals has made a significant impact on the production and productivity of crops and livestock. Yet, there is much more to be desired than is being done. We have failed to keep pace with the emerging applications. Seed replacement for wheat has been very slow around 20 percent a year it should be at least 50 percent. The balanced use of fertilizers is totally missing. Nitrogen is the major fertilizer being used whereas our soils are deficient in several nutrients.

The application of farm chemicals is often imprecise and timing of operations is not given due attention. The nexus between land distribution and technological transformation in the canal colonies 1880s onwards makes for an interesting study. The land development followed gravity-driven irrigation water flows from rivers. Back then, the relationship between average land holding and water allocation supply controlled wara bandi minutes per acre distribution of time slots was efficient for a cropping intensity of 60 percent. Now, with land fragmentation over nearly six generations and a cropping intensity of 200 percent, the irrigation system struggles to be optimum. The water deficit is being met by excessive and expensive groundwater pumping. A shift to high efficiency irrigation requires energy, pipes and on-farm water storage structures, which are beyond the reach of a majority of farmers. A complete system reform is required to convert supply of canal irrigation to a demand-driven water delivery. With increasing urbanization, there will soon be greater competition for water allocation and pricing mechanisms to the disadvantage of agriculture. Farm practices have to be made water-efficient to bear the cost of water volumes and delivery systems. The current investment in HEI needs to be revisited to

make it compatible with the ground realities rather than allowing elite capture. Animal draft power has nearly vanished and tractors are the standard farm horsepower. The tractors currently account for nearly half the required horsepower. The tractors are currently equipped with very few implements and are insufficient to meet the modern mechanization requirements ploughing, tillage, planting, spreading, and spraying, harvesting, drying, grading, transportation.

The future lies with the next generation of mechanization the use of precision agriculture equipment and application of data science and drones. There is a strong case for the provision of comprehensive rental services to replace the current

tractorisation. High efficiency irrigation requires energy, pipes and on-farm water storage structures, which are beyond the reach of a majority. A complete system reform is required to convert canal supply irrigation to a demand-driven delivery of water. Sir William Roberts, the principal of erstwhile Punjab Agriculture College and Research Institute, Lyallpur Faisalabad wrote a paper in 1925 to highlight the need to create a seed industry in the country, long before the Green Revolution of 1960s. By then the use of hybrid corn seed was already in practice elsewhere. He abandoned academics and created Roberts Seed and Ginning business in Khanewal and Rahim Yar Khan.

Original Link: <https://www.thenews.com.pk/tns/detail/1016386-technology-gap-in-agriculture>

Agri Insurance Essential for Farmers' Economic Security

ISLAMABAD-Agricultural insurance is crucial for ensuring farmers financial security in the wake of extreme events, which often cause extensive damage to their crops. However, unfortunately, agri-insurance has not attracted significant attention in Pakistan primarily because the country's agricultural sector is riskier due to a range of factors.

Talking to Wealth, Irshad Khan Abbasi, Head of Innovation and Integration at Pakistan Poverty Alleviation Fund PPAF, said Islamabad had consistently lagged behind the rest of the world in terms of agricultural insurance. A lot of farmers in developed countries use agriculture insurance as a form of financial protection. Such type of insurance is vital for a country like Pakistan, a largely agrarian nation, where agriculture accounts for 22 of GDP, and at least 37.4 of the labour force is attached to the

sector, meaning over 65-70 of population depends on agriculture for livelihood, he explained. Irshad Abbasi said as Punjab met almost 76 of the country's total agricultural needs, so there was a dire need for introduction of agro-insurance in the province. He pointed out that for the first time in 1983, livestock insurance was introduced in Pakistan, but the endeavor remained unsuccessful.

For the success of any agro-insurance programme, it is essential to connect farmers with banks, a crucial step in overcoming financial vulnerability of growers in the event of losses to their crops, he said. The PPAF officer said enabling farmers access to banking facilities would help them cope with the effects of floods, droughts, locust attacks, or fires as they would be assured of being compensated for losses.

Original Link: <https://www.nation.com.pk/04-Dec-2022/agri-insurance-essential-for-farmers-economic-security>

International News

Global Leaders Tackle Conservation at UN Biodiversity Conference

Canada's Prime Minister, Justin Trudeau, welcomed the delegates of the 15th Meeting of the Conference of Parties (COP15) to the United Nations Convention on Biological Diversity (CBD). Being one of the countries promoting conservation, [Canada](#) stepped up to be the host of COP15, which takes place from December 7 to 19, 2022.

[Biodiversity](#) is a crucial topic of discussion that concerns human health and well-being, economic prosperity, food safety, and security, among other areas vital for the survival of humans and societies. According to CBD, coordinated action among political leaders and key stakeholders is the key to safeguarding life on earth. Thus, the COP15 action agenda includes access and benefit sharing, biosafety,

climate change adaptation and mitigation, food systems and health, sustainable production and production, and other vital topics. Global leaders and high-level representatives are present at COP15 to tackle these topics.

“When people think of Canada, they think of our landscapes and the richness of our nature – parts of who we are. Today, we welcome the world to Montréal to continue working together to make sure the planet we leave to our kids and grandkids has clean air, clean water, and an abundance of nature to enjoy,” said Rt. Hon. Justin Trudeau, Prime Minister of Canada.

Canada's Minister of Environment and Climate Change Hon. Steven Guilbeault was also present at COP15. He said, “the fight to protect nature has never been more important than it is right now. With a million species at risk of extinction around the world, COP15 is a generational opportunity to work together to halt and reverse biodiversity loss and create a nature-positive world. Canada stepped up to welcome the world for this conference and sees it as an opportunity to rally federal, provincial, territorial, and Indigenous ambition to protect 30 percent of our lands and waters by 2030.”

Read more from the following websites: [Prime Minister of Canada](#), [Government of Canada](#), and [CBD](#).

New Zealand to Implement Plant Variety Rights Act and Regulations in 2023

The New Zealand Intellectual Property Office announced that the New Plant Variety Rights Act and Regulations will come into force on January 24, 2023.

According to the recommendations of the Wai 262 report, the following changes will be implemented:

- The Māori Plant Varieties Committee will be created to support early engagement between breeders and kaitiaki, assess the impact of a Plant Variety Rights (PVR)

grant on kaitiaki relationships, and make determinations on whether certain applications should or should not proceed.

- There are new disclosure requirements from breeders if indigenous plant species or other species of significance to Māori are involved.
- The ability to refuse the grant of a PVR if kaitiaki interests are affected.

Read more from the [New Zealand Intellectual Property Office](#).

Pakistan Looks Forward to Cooperating with China on Banana Cultivation

BEIJING - Pakistan is looking forward to cooperate with China through collaborative research in an effort to enhance its production of banana. China's contribution to the international banana market is around 4.5%. However Pakistan's contribution is less than 0.5%. We are far behind. I think China and Pakistan can cooperate through collaborative research. We can progress and get benefit from each other, Noshervan Haider, CEO, and Sprouts Biotech Laboratories, said in an interview with China Economic Net. Up till today, Sino-Pak cooperation on banana is still very limited. Lack of high-quality seeds, advanced cultivation technology and logistic facility remain a large obstacle to boosting banana production and exports in Pakistan, for which Pakistani researchers and farmers are looking forward to getting support from China.

The main problem we have here is the choice of good seeds. And, the rate of fertilizers is very high here. We lack good seeds. Nowadays we have a kind of seeds here known as tissue culture seed, which is also imported from China. We should choose good seeds. China is helping us in this already. But if we receive more help then we can achieve better results, Imran Shah, a farmer from NQ Farms said. When it comes to planting technology, research on tissue culture of banana is being carried out in some labs in Pakistan.

The production of tissue culture banana is three times higher than that of our conventional banana. Conventional banana harvests in 16 to 18 months while our tissue culture banana fruits in the seventh month. Tissue culture banana is disease free and harsh weather tolerant. The production of plants produced in our lab lasts throughout the year. People get a lot of benefit from it, Noshervan Haider, CEO,

and Sprouts Biotech Laboratories told CEN. However, as Noshewan Haider sees it, in most areas of Pakistan, the growing of banana is not as per proper method, which makes banana production not

as high as it should be. Pakistani researchers long for Chinese technologies that may help Pakistan further improve local banana yield.

Original Link: <https://www.nation.com.pk/04-Dec-2022/pakistan-looks-forward-to-cooperating-with-china-on-banana-cultivation>

Phinest Cannabis Introduces Symbiotic Genetics into the Tissue Culture Roster

Cannabis, California's leading cannabis micro propagation nursery and operator of North America's largest cannabis tissue culture facility announces a new licensing agreement with Symbiotic Genetics. Under the agreement, Phinest nursery is granted a license for two cannabis cultivars, one exclusively, for sale to licensed cultivators and retailers throughout California. Founded in 2014, Symbiotic Genetics has proven their reputation as a leading California genetics team, introducing strains like Purple Punch 2.0, Mimosa, Banana Punch, and Wedding Crasher to market. Trey Ish, President of

Symbiotic Sacramento says, Symbiotic Genetics is very excited to team up with Phinest, the pioneer of commercial cannabis tissue culture. Our agreement allows for our premium genetics to be delivered as vigorous, disease-free plants to both home and commercial growers throughout California. The agreement adds the strains Orange Malt and Amarelo 9 to the Phinest nursery catalog. Matthew Wich, COO of Phinest Cannabis comments, Working with Symbiotic and bringing their strains to market through our nursery platform builds on Phinest's reputation as a purveyor of elite cannabis cultivars.

Original Link: <https://www.prnewswire.com/news-releases/phinest-cannabis-introduces-symbiotic-genetics-into-the-tissue-culture-roster-301692976.html>

Tissue Culture Tech Seen to Help Coconut Farmers

The Philippine Coconut Authority PCA underscored that innovating sustainable and climate-resilient means of coconut production is a top priority to help coconut farmers achieve better and increased yields. PCA deputy administrator Roel Rosales said Thursday, December 1, during the Davao Region Coconut Conference and Trade Summit that they are close to perfecting the process of growing coconut through tissue culture that will significantly help farmers. The tissue culture is similar to what we do in bananas where one tissue can produce so many planting materials.

of Agri-biotech Applications defined plant tissue culture TC as the cultivation of plant cells, tissues, or organs on specially formulated nutrient media. Under the right conditions, an entire plant can be regenerated from a single cell. Rosales added that their research with the Department of Science and Technology DOST has yielded at least 200 tissues. To strengthen his claim, Rosales also mentioned that research in Mexico has proven that tissue can produce thousands of planting materials. With one tissue from the nut itself, it can produce several hundred, he said, adding that they are now in the final stage of the research. We have actually tested trees already planted on the field that are products of the said technology.

In that way, you'll be able to get the exact genetic characteristic of the source with the proper selection, he said. The International Service for the Acquisition

Original Link: <https://www.sunstar.com.ph/article/1947552/davao/business/tissue-culture-tech-seen-to-help-coconut-farmers>

Agri-Biotech News

Plants Yield Better When Grown Among Genetically Similar Plants

Swiss scientists from the University of Zurich and Agroscope were able to identify [genes](#) that promote cooperation and higher yields of plant populations

when monoculturally grown. The findings can help breeders develop plants with increased productivity using [conventional breeding](#) methods.

They theorized that the most cooperative genotype will perform best with similarly cooperative neighbors yet will exhibit poor performance when with a highly competitive company. They tested this theory using *Arabidopsis*. They planted it among other plants that were similar in terms of genetics to mimic monoculture, while another was planted among “tester” genotypes that had different growth strategies. The data that the scientists gathered from the two sets were compared to determine the overall vigor of the plants and the difference between their growths. They were then able to determine which set expressed better growth and the ability to cooperate with genetically similar individuals so that their neighbor plants also grew well.

Further investigation led the scientists to create their own system that identified the plant alleles that promoted cooperation, which they verified using genome-wide polymorphism data. They were able to pinpoint the allele in a small group of linked polymorphisms. When plants carrying this allele were grown in close proximity, they collectively produced 15% more biomass. The scientists also found that the cooperative effect came with reduced root competition.

The same cooperative strategy could be used for discovering cooperative alleles for other plant characteristics, said the researchers. Doing so may be able to improve plant breeding programs to help increase yields.

Read [PLOS](#) and [EurakAlert!](#) to know more.

Researchers Identify Genes to Help Fruit Adapt to Droughts

Researchers from the Boyce Thompson Institute (BTI) and Cornell University have completed the first study that provides a comprehensive picture of changes in gene expression in response to water stress in tomatoes and identified [genes](#) that could help plant breeders develop fruit that can cope with [drought](#) conditions.

Led by BTI Assistant Professor Carmen Catalá, who is also a research associate in the School of Integrative Plant Science at Cornell and Philippe Nicolas, a postdoctoral researcher in Catalá’s lab, the team identified a number of genes that are involved in water stress response in tomatoes. “We can now begin to select candidate genes that could help breeders develop fruit that can adapt to drought conditions, and not just tomatoes but also grapes, apples, and fleshy fruit in general,” said Catalá.

The research team looked at gene expression in tomato leaves and six fruit organs, including pericarp, placenta, septum, columella, jelly, and seeds, at two different periods (growing and ripe fruit) and under four different water stress conditions (none, mild, intermediate, and strong). They found that each of the fruit organ tissues changed in unique ways over time. According to Catalá, less than 1% of the expressed genes affected by water stress were shared among all six fruit tissues, and more than 50% of the affected genes were specific to a single tissue. They also found that mild drought brought some positive effects. For example, water stress increases the amount of lycopene in ripe tomatoes. Water-stressed fruit also had higher levels of starch biosynthesis, which could yield sweeter tomatoes.

For more details, read the article in [BTI News](#).

World's First Rice Seeds Grown and Harvested in Orbit in Chinese Spaceflight Returns to Earth

On December 4, 2022, the Chinese spaceflight Shenzhou-14 returned to Earth after six months in space. The third batch of space science experiment samples also arrived with the return capsule delivered to Beijing, including the world's first [rice](#) seedlings harvested in space.

Together with the rice seedlings, experimental seeds of *Arabidopsis thaliana*, or thale cress, also grew

vigorously in the space station. The two plants were cultivated in space for 120 days and completed the entire growth process from seed to seed. The experimental seeds of rice and thale cress were brought into space in late July. The experiment was officially launched on July 29, 2022, with the nutrient injection and concluded on November 25, for a total of 120 days. During the process, thale cress and rice seeds sprouted, grew, flowered, and bore seeds.

Thale cress and rice were chosen for the experiment because thale cress represents many kinds of vegetables, such as bok choy and oilseed rape, while rice represents grain crops, including [wheat](#) and [corn](#), said Zheng Huiqiong, a research fellow at the Chinese Academy of Sciences Center for Excellence in Molecular Plant Sciences, who is also the team

leader of the program. Preliminary results showed that in space, the rice plants became looser with larger leaf angles. Short-grain rice grew shorter while the height of tall-grain rice was not significantly affected. It was also observed that the spiral upward movement of rice leaf growth controlled by the biological clock was more accentuated in space.

For more details, read the article in the [Global Times](#).

FAO Publishes Issue Paper on Gene Editing and Agrifood Systems

The Food and Agriculture Organization of the United Nations (FAO) has released *Gene Editing and Agrifood Systems*, a science- and evidence-based *Issue Paper* that presents a balanced discussion of the key aspects of [gene editing](#), including the consequences for human hunger, human health, [food safety](#), effects on the [environment](#), animal welfare, socioeconomic impact and distribution of benefits.

The paper's executive summary states that gene editing has the potential to improve food security, nutrition, and environmental sustainability, but issues of safety must be considered, and potential problems associated with new products must be identified to ensure their safe and sustainable use and satisfy consumers. Considerable information has been

gained from previous experiences with transgenic plants and animals relevant to gene editing and its products. Gene editing can be inherently more precise than other methods used to date, which could reduce the likelihood of any harmful effects on human health and the environment.

With a foreword written by the Nobel Laureate in Chemistry Jennifer Doudna, who also discovered the gene editing tool [CRISPR](#), the *Issue Paper* contains six chapters on advances in plant and animal breeding; potential hazards, benefits, and gene editing's impacts on the environment and society; governance and regulation; and the roles of the private and public sectors and transformative partnerships.

For more details, download a copy of the *Issue Paper* on the [FAO website](#).

Health-Biotech News

Modified *Agrobacterium* Strain Useful for Switchgrass Transformation

An *Agrobacterium* strain that cannot produce methionine is useful for switchgrass transformation, according to the University of Georgia and University of Colorado Boulder researchers. Their research paper is published in *Transgenic Research*.

Agrobacterium tumefaciens has revolutionized plant science because it can transfer DNA into plant cells from a broad host range of species. However, the strains available within the public sector need modifications that allow simplified techniques or improve overall plant transformation efficiency.

Thus, the research team used homologous recombination to develop methionine auxotrophs of two common *A. tumefaciens* strains, LBA4404 and EHA105.

The findings showed that the EHA105 strains were more effective in switchgrass transformation, while both strains worked efficiently for the rice control. The use of auxotrophs led to reductions in bacterial overgrowth during co-cultivation and decreased the need for antibiotics.

Read the open-access research article in [Transgenic Research](#).

New Height-Reducing Gene Can Help Wheat Grow in Drier Soil

Scientists from the John Innes Centre and CSIRO [Australia](#) discovered *Rht13*, a height-

reducing [gene](#) in wheat. This new finding may allow farmers to plant [wheat](#) seeds deeper into the soil

without the adverse effects on seed emergence that is common when using existing wheat varieties.

[Conventional](#) wheat varieties that were produced during the Green Revolution put more energy into grain production causing lower plant heights. But these plants are unable to survive when planted deep in the [soil](#) where more moisture can be found because the dwarf plants fail to reach the top. *Rht13* offers a solution to this problem by acting in plant tissues higher up in the wheat stem. This means that the dwarfing mechanism occurs only when the seedling has fully emerged from the soil. The gene also suggests that the additional agronomic benefits of the new semi-dwarfing gene may include stiffer stems that can help the plant withstand storms.

The gene was discovered after the publication of the Pan Genome in 2020, an atlas of 15 genomes of global wheat varieties. The researchers used RNA and chromosome sequencing to identify *Rht13*. They found a point mutation change that caused the *Rht13* locus to encode the defense-related NB-LRR gene to be always switched on.

Further testing confirmed that *Rht13* variation represents a new type of reduced height gene. According to the scientists, plants with this gene have more surviving chances in drier [environments](#), and will have stiffer stems and possibly better resistance against certain pathogens. The gene can also be rapidly bred into wheat varieties and gives wheat breeders an excellent genetic marker to develop more [climate](#)-resilient wheat.

More details can be found in [John Innes Centre's](#) press release.

Long Lost Chromosome Increases Nitrogen Efficiency of Modern Maize

Teosinte high protein 9 (*THP9*) is a chromosome that encodes an enzyme vital to the nitrogen metabolism of teosinte, maize's ancestor. It is highly expressed by teosinte, but not by modern [maize](#). Its recent discovery offers maize breeders better opportunities to develop new lines that can be grown under limited [nitrogen](#) conditions, while increasing the crop's seed protein content.

The researchers from the Chinese Academy of Sciences discovered it used a method called “trio binning” which simplified teosinte's haplotype assembly. They first resolved allelic variations, which helped piece together teosinte's haplotype DNA sequence. They then figured that characterizing the [genes](#) responsible for the high-protein trait in

teosinte might reveal a more diverse set of QTLs as compared to the modern maize. And as it turned out, they found a deletion in the intragenic non-coding segment of the modern maize that caused incorrect splicing of the *THP9* mRNA.

THP9 was introduced to the modern maize line B73's genome via introgression. This resulted in an increase in seed protein content of the transgenic inbred strain, as well as the free amino acids throughout the plant that included asparagine. The researchers also noted that these traits did not affect the yield of the plant. This discovery highlighted the possible value of maize hybrids that contain the *THP9-T* allele, which may be able to grow in low nitrogen-soil conditions without causing negative effects on yield.

For more details, see [Nature](#) or [Genetic Engineering and Biotechnology News](#).

FAO Pushes for Transformation of Agri-food Systems to Address Climate Crisis

The 2022 United Nations Climate Change Conference (COP27) discussions at Sharm El-Sheikh, Egypt, highlighted the urgency to reduce greenhouse gas emissions. Thus, the Food and Agriculture Organization of the United Nations (FAO) looked into its expertise and experience to initiate actions on how agri-food systems could be modified and contribute towards [climate change](#) mitigation.

According to Zitouni Ould-Dada, the deputy director of FAO's Climate and Environment division, FAO

was a part of four initiatives launched by the Egyptian Presidency at COP27, which are as follows:

- Food and Agriculture Sustainable Transformation (FAST) aimed at supporting climate action in agri-food systems;
- Initiative on Climate Action and Nutrition (I-CAN) to support member states implement policies for improved access to nutritious and healthy diets from sustainable food systems;

- Action for Water Adaptation and Resilience (AWARE) to address better management of water for climate adaptation and resilience; and
- waste management in Africa to treat and recycle at least 50% of the solid waste produced in Africa by 2050.

Read more from [FAO](#).

Philippines Continues Biotech Lead in Southeast Asia - USDA FAS Report

In its November 14, 2022, *Agricultural Biotechnology Annual*, the US Department of Agriculture Foreign Agricultural Service reports that the Philippines continues to be a leader in biotechnology in Southeast Asia, having been the first in the region to have a regulatory framework on [genetically engineered](#) (GE) crops.

The report says the Philippines is a regional biotechnology leader and the first country in the world to approve [Golden Rice](#) for commercial propagation. The [Bt Eggplant](#) biosafety permit, signed on October 17, 2022, allows commercial propagation of the crop. Farmers in [selected provinces](#) in the country have started planting Golden Rice, while biotech corn acceptance has grown, with more than 600,000 hectares planted in 2021.

The Annual also points out that the country is moving forward with the implementation of three regulations: [revised Joint Department Circular](#)

[\(JDC1\)](#); Department of Agriculture (DA) Memorandum Circular (MC) No. 8 pursuant to the revised JDC1, which provides the regulatory policy for importation, handling and use, transboundary movement, release into the environment, and management of GE plants and plants products derived from the use of modern biotechnology; and the National Committee on Biosafety of the Philippines [NCBP Resolution No. 1](#), or, “the Regulation of Plant and Plant Products Derived from the Use of Plant Breeding Innovations (PBIs) or New Plant Breeding Techniques (NBTs).” This regulation covers plants and plant products derived from PBI/NBTs and provides guidance for determining whether or not a specific plant should be regulated as a GE crop.

The passing of these three regulations signifies the country's commitment to science and improvements in biotechnology.

For more details, download the [Agricultural Biotechnology Annual](#).

UC San Diego Team Identifies CO2 Sensor in Plants that Controls Water Loss

Scientists at the University of California San Diego (UC San Diego) have recently made a breakthrough in identifying the long-sought carbon dioxide (CO2) sensor in Arabidopsis plants and unraveled its functioning parts. Researchers have discovered more than 50 years ago that plants can sense CO2, but have not identified the sensor or explained how it works within plants.

In a paper published in *Science Advances*, UC San Diego project scientist Yohei Takahashi, Professor Julian Schroeder, and their colleagues identified the CO2 sensor mechanism and detailed its [genetic](#), biochemical, physiological, and predicted structural properties. The research team found that plants sense changes in CO2 concentration by the reversible interaction of two proteins to regulate stomatal

movements. The two plant proteins working together were identified as 1) a “high leaf temperature1” protein kinase known as HT1 and 2) specific members of a mitogen-activated protein kinase family, or “MAP” kinase enzyme, known as MPK4 and MPK12.

The team's findings have been filed in a UC San Diego patent and could lead to innovations in efficient water use by plants as CO2 levels rise. “If we can use this new information to help trees respond better to increases in CO2 in the atmosphere, it's possible they would more slowly dry out the soil. Similarly, the water use efficiency of crops could be improved—more crop per drop,” said Professor Julian Schroeder.

For more details, read the article in [UC San Diego Today](#).

Scientists Use Three Techniques and Found Three Species have Different Ways to Fight Drought

A team of scientists has combined three advanced research techniques that are rarely used together and found how different types of plants protect themselves from harsh conditions. The three techniques reveal a surprising amount of information about the chemical processes inside plants.

Scientists working under the Facilities Integrating Collaborations for User Science (FICUS) program examined the effects of [drought](#) on chemical processes inside the roots of three tropical rainforest species. The team included researchers from the University of Arizona, the Pacific Northwest National Laboratory, and the University of Freiburg. To understand the chemical functions of plants, including how they use carbon, the team combined cutting-edge [metabolomic](#) and imaging technologies at the Environmental Molecular Sciences Laboratory, a Department of Energy user facility. They used powerful nuclear magnetic resonance spectroscopy to

identify the type and structure of molecules in the plant roots. They then created detailed images of tissues using mass spectrometry (matrix-assisted laser desorption/ionization mass spectrometry) and took nanoscale measurements of elements and isotopes (nanoscale secondary ion mass spectrometry).

These techniques produced insights into different defense mechanisms that plants use to survive drought. The team found that one species added woody lignin to thicken its roots, the second secreted antioxidants, and fatty acids as a biochemical defense, and the third appeared less affected by drought conditions, but the soil around it had a higher level of carbon. This indicates that the plant and the microbes in the soil were working together to protect the plant. This study showed how combined techniques could help identify different drought-tolerance strategies and ways to keep plants thriving.

For more details, read the article on the [U.S. Department of Energy website](#).

Alternative *Agrobacterium* Method Bypasses Tissue Culture to Multiply Sweet Potato Cultivars

[Chinese](#) scientists were able to multiply sweet potatoes by utilizing both *Agrobacterium rhizogenes* and the crop's natural transgenic trait. Their method skips the need for tissue culture to obtain genetically modified sweet potato plants.

According to previous studies, sweet potato is a naturally [transgenic](#) plant that contains two *Agrobacterium* transfer DNAs: IbT-DNA1 and IbT-DNA2. On the other hand, *Agrobacterium rhizogenes* has two transferable TNA regions: TR-DNA that corresponds to IbT-DNA1 and TL-DNA to IbT-DNA2. The scientists theorized that this bacterium-plant relationship is more symbiotic than parasitic, and that *Agrobacterium rhizogenes* can be used to induce hairy roots upon wounding and infecting plant leaves or stems. The hairy roots may then contain the T-DNA of the bacterium's binary vector if co-transferred, and these roots may serve as adventitious roots with the potential to develop into storage roots with heritable [genetic modifications](#).

More details from [Plant Biotechnology](#).

To test their hypothesis, the scientists used Shangshu 19 sweet potato variety. They inoculated its vine cuttings with *Agrobacterium rhizogenes* K599-IbRPS5a:GUS and planted them under natural field conditions where they also induced hairy roots and plant growth. Initial PCR testing found that nearly 100% of the infected vine cuttings could produce transgenic positive storage roots. Whole plants were regenerated and underwent qRT-PCR analysis which showed that 90-100% of the infected plants formed positive storage roots.

The study determined that the *Agrobacterium rhizogenes* method is faster, simpler and more efficient than having to go through tissue culture. The researchers also concluded that the hairy root lines established from single root meristems are cellular clones, and every transgenic storage root represents an independent transformation event.

Enhanced Prime Editing Leads to Heritable Mutations in Maize

The *Journal of Integrative Plant Biology* released a breakthrough report that optimized prime editing can efficiently generate heritable mutations in [maize](#). Researchers from China Agricultural University and Henan University conducted the study.

Efficiency is the main challenge in prime editing in maize. In research involving mammalian cells and rice, prime editing efficiency was significantly improved through prime editing guide RNAs (pegRNAs) that led to optimizing the primer editor (PE) protein and modifying cellular determinants of

prime editing. Thus, the research team tested the same strategy in maize using a system called ePE5.

The researchers reported that the ePE5max system efficiently generated heritable mutations that conferred resistance to herbicides that block the activity of 5-enolpyruvylshikimate-3-phosphate synthase (EPSPS), acetolactate synthase (ALS), or acetyl CoA carboxylase (ACCase). Based on the results, the ePE5max system has high efficiency that generates heritable mutations in maize target [genes](#), eliminating the main challenge in using prime editing in maize.

Read the open-access article in the [Journal of Integrative Plant Biology](#).

Other than Crop Biotech News

EFSA Concludes GM Maize MON 95379 Safe

The European Food Safety Authority (EFSA) GMO Panel released its Scientific Opinion on the safety of [genetically modified](#) (GM) [insect protected](#) maize MON 95379, for import, processing, and food and feed uses within the European Union (EU) and does not include cultivation.

Following the submission of application EFSA-GMO-NL-2020-170 under Regulation (EU) No 503/2013 from Bayer Agriculture BV, the EFSA GMO Panel was asked to deliver a Scientific Opinion on the safety of [GM maize](#) MON 95379. In their Scientific Opinion, the GMO Panel reports that the molecular characterization data and bioinformatic analyses do not identify issues requiring food/feed safety assessment and that none of the identified differences in the agronomic/phenotypic and compositional characteristics tested between maize

MON 95379 and its conventional counterpart needs further assessment. The GMO Panel does not identify safety concerns regarding the toxicity and allergenicity of the Cry1B.868 and Cry1Da₇ proteins as expressed in maize MON 95379 and finds no evidence that the genetic modification impacts its overall safety.

In the context of this application, food and feed from maize MON 95379 do not represent a nutritional concern in humans and animals. The GMO Panel concludes that maize MON 95379 is as safe as the conventional counterpart and non-GM maize reference varieties tested, and no post-market monitoring of food/feed is considered necessary. In the case of the accidental release of viable maize MON 95379 grains into the environment, this would not raise environmental safety concerns.

For more details, read the scientific opinion in the [EFSA Journal](#).

Exploitation of Farmers

The fight of farmers is complicated, multifaceted, but extremely important. They fight to secure food and future of humanity. They should be treated as hero, especially in a country where 58.8pc population is food insecure. But, Pakistan is not recognizing this, rather moving in other direction. The insensitive behavior of the state has broken the back of farming community. They have been left with no choice but to protest. On the contrary, farmers in developed world are considered backbone of their country and

guarantee of food security. They are treated well by the states and get subsidies. A study was published recently on the state of subsidies provided to farmers in 12 countries. It revealed these countries give 700 billion to farmers on annual basis.

A healthy amount is being provided as direct transfer to farmers. In addition, these countries are investing heavily on research, development and agriculture-related infrastructure. The breakdown of data showed China provided 185 billion, EU 101.3 billion, US 48.

9 billion, Japan 37.6 billion, Indonesia 29.4 billion and South Korea 20.9 billion as subsidy to farming community. They deem it necessary to secure food, create jobs and eliminate poverty. Besides, farming community is organized in these countries and they do not allow leadership to work against their interests. Keeping in mind these facts, let's analyze state of farming community of Pakistan. First of all, Pakistan provides meager subsidies to farmers and agriculture sector. Second, Pakistan has adopted blanket subsidy policy without distinction of big or small farmers.

It's a wrong policy choice as it leads to exploitation of subsidies by big farmers. Small farmers are used as dummy to allocate subsidies. There is need to revise

this policy and come up with a new one with a focus on small and resource poor farmers.

Third, agriculture-related infrastructure is extremely poor. Supply chain management presents a pathetic picture. Roads are in bad shape. Agriculture commodities like fresh vegetables and fruits are being transported by ordinary loaders which impact the quality of commodities. There are very few cold storages which cannot cater the needs of farmers. Lack of refrigerated transportation further complicates the situation. Fourth, agriculture market structure is anti-farmer. They have to buy expensive inputs like fertilizer, seed and pesticides. Quality of inputs is another issue which is impacting productivity and production.

Original Link: <https://www.thenews.com.pk/print/1016905-exploitation-of-farmers>

Plant Breeding Innovations

Study Reveals Role of Soybean 14-3-3 Gene on White Mold Resistance

Researchers from Ottawa Research and Development Centre and partners investigated the role of the soybean 14-3-3 gene *Glyma05g29080* on white mold resistance and nodulation using [CRISPR-Cas9](#) editing and [RNA silencing](#). Their findings are published in the journal *Molecular Plant-Microbe Interactions*.

The 14-3-3 gene family plays a vital role in physiological processes, such as controlling metabolism, hormone signaling, cell division, and

responses to various biotic and abiotic stresses. Thus, the research team conducted a loss-of-gene function study with CRISPR-Cas9 and RNAi. Particle bombardment was used to insert CRISPR and target the soybean 14-3-3 gene and an RNAi construct.

Results showed that the transgenic plants and their progeny were more susceptible to *Sclerotinia sclerotiorum* infection and significantly reduced nodulation. These findings confirm the role of the 14-3-3 gene in both nodulation and defense.

Download the open-access article in [Molecular Plant-Microbe Interactions](#).

Alternative Agrobacterium Method Bypasses Tissue Culture to Multiply Sweet Potato Cultivars

[Chinese](#) scientists were able to multiply sweet potatoes by utilizing both *Agrobacterium rhizogenes* and the crop's natural transgenic trait. Their method skips the need for tissue culture to obtain genetically modified sweet potato plants.

According to previous studies, sweet potato is a naturally [transgenic](#) plant that contains two *Agrobacterium* transfer DNAs: IbT-DNA1 and IbT-DNA2. On the other hand, *Agrobacterium rhizogenes* has two transferable TNA regions: TR-DNA that corresponds to IbT-DNA1 and TL-DNA to IbT-DNA2. The scientists theorized that this bacterium-plant relationship is more symbiotic than

parasitic, and that *Agrobacterium rhizogenes* can be used to induce hairy roots upon wounding and infecting plant leaves or stems. The hairy roots may then contain the T-DNA of the bacterium's binary vector if co-transferred, and these roots may serve as adventitious roots with the potential to develop into storage roots with heritable [genetic modifications](#).

To test their hypothesis, the scientists used Shangshu 19 sweet potato variety. They inoculated its vine cuttings with *Agrobacterium rhizogenes* K599-IbRPS5a:GUS and planted them under natural field conditions where they also induced hairy roots and plant growth. Initial PCR testing found that nearly 100% of the infected vine cuttings could produce

transgenic positive storage roots. Whole plants were regenerated and underwent qRT-PCR analysis which showed that 90-100% of the infected plants formed positive storage roots.

The study determined that the *Agrobacterium rhizogenes* method is faster, simpler and more

More details from [Plant Biotechnology](#).

efficient than having to go through tissue culture. The researchers also concluded that the hairy root lines established from single root meristems are cellular clones, and every transgenic storage root represents an independent transformation event.

Enhanced Prime Editing Leads to Heritable Mutations in Maize

The *Journal of Integrative Plant Biology* released a breakthrough report that optimized prime editing can efficiently generate heritable mutations in [maize](#). Researchers from China Agricultural University and Henan University conducted the study.

Efficiency is the main challenge in prime editing in maize. In research involving mammalian cells and rice, prime editing efficiency was significantly improved through prime editing guide RNAs (pegRNAs) that led to optimizing the primer editor (PE) protein and modifying cellular determinants of

prime editing. Thus, the research team tested the same strategy in maize using a system called ePE5.

The researchers reported that the ePE5max system efficiently generated heritable mutations that conferred resistance to herbicides that block the activity of 5-enolpyruvylshikimate-3-phosphate synthase (EPSPS), acetolactate synthase (ALS), or acetyl CoA carboxylase (ACCase). Based on the results, the ePE5max system has high efficiency that generates heritable mutations in maize target [genes](#), eliminating the main challenge in using prime editing in maize.

Read the open-access article in the [Journal of Integrative Plant Biology](#).