Seed Connect

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Seed Connect wishes its readers a very Happy New Year!!

In this edition we focus on the power and potential of big data in answering multiple questions that have been intriguing plant scientists as well as provide solutions to the new problems faced by farmers due to climate change, disease and pest infestation. In the recent years a variety of crops have been sequenced, their proteomic and metabolic data collected.

One such study has been conducted by researchers from the Boyce Thompson Institute (BTI) and Cornell University that provides data on changes in gene expression in response to water stress in tomatoes and identified genes that could help breeders develop drought tolerant tomatoes. The study elucidated that an improvement in drought tolerance also led to increases in the amount of lycopene and starch making the tomatoes sweeter.

A similar combined population genetics, genomics study in rice identified a domestication-selected DNA damage repair mechanism along with its corresponding elite modules involving chilling stress in rice. It was a major quantitative trait loci gene for chilling tolerance and could help develop R&D designs to improve chilling tolerance in rice and other crops.

The economics of generating such data have included even orphan crops like jackfruit. The genome sequence of jackfruit will be used for molecular breeding for stress tolerant, high-quality fruit that will be commercially produced year round. Scientists are also using imaging and metabolomic data to study the chemical functions of plants under stress. Studies have shown that different species use varied mechanisms to combat stress including woody lignin to thicken their roots, secreting antioxidants or fatty acids as a biochemical defense, and these mechanisms also increased the carbon levels in soil. All these examples reiterate the potential of the molecular data in plant science and open new vistas in crop improvement.

We hope that the article referred above and other news in this newsletter will give you an overview of the progress in agriculture. We also hope it is informative enough and gives you enough fodder in

support of technology and its potential in the newsletter.

Mallika Verma

Director- Government Affairs

Federation of Seed Industry of India

News from India and Around the World

How to Grow More Produce in Small Spaces A Step By Step Guide to High Density Farming

The Better India

Biju Narayanan, a former engineer, quit his career about 10 years ago to take up farming. He says he has always been interested in the field and his family owned a few acres of rubber farm in Kannur. But the land was rife with rubber plantations, which he worried would eventually degrade the soil quality.

Biopiracy: Making rich nations pay for Indigenous knowledge

https://www.dw.com/en/what-is-biopiracy-and-how-could-it-threaten-deal-to-save-nature/a-62172855

Digital biopiracy will be a key sticking point at biodiversity talks in Montreal, as developing countries increasingly call on richer nations to share the profits from breakthroughs based on their natural resources.

Resurrecting Climate-Resilient Rice in India

https://www.yesmagazine.org/environment/2022/12/14/rice-india-climate

Seemingly miraculous varieties that can withstand drought, flood, and saltwater intrusion are the result of centuries of selective breeding by ancient farmers. Until as recently as 1970, India was a land with more than 100,000 distinct varieties of rice. Across a diversity of landscapes, soils, and climates,

native rice varieties, also called “landraces,” were cultivated by local farmers. And these varieties sprouted rice diversity in hue, aroma, texture, and taste. But what sets some landraces in a class of their own—monumentally ahead of commercial rice varieties—is their nutrition profiles. This has been proved by the research of Debal Deb, a farmer and agrarian scientist whose studies have been published in numerous peer-reviewed journals and books.

EO and Spatial Analytics for Sustainable Agriculture

https://www.geospatialworld.net/prime/eo-spatial-analytics-sustainable-agriculture/

The access to archival satellite data, combined with current agricultural season data can help cultivators gain insights into the crop condition in different areas, and stages of crop growth, allowing them to plan resources accordingly.

OUAT releases little millet variety with stronger quality, gets three patents

https://www.newindianexpress.com/cities/bhubaneswar/2022/dec/26/ouat-releases-little-millet-variety-with-stronger-quality-gets-three-patents-2531855.html

As the country is all set to observe 2023 as the international year of millets, Odisha University of Agriculture and Technology (OUAT) has developed a little millet variety with enhanced productivity and quality. The new variety Kalinga Suan 18 was recently released by the central variety release committee.

India will build Indian Millet Park in Zimbabwe

https://pkbnews.in/india-will-build-indian-millet-park-in-this-country-know-what-benefits-it-will-have/

United Nations Declared the next year as the year of coarse grain. On the other hand, India **Zimbabwe** An Indian Millet Park is proposed to be set up as part of this initiative. Significantly, the proposal was announced by President Draupadi Murmu when the Speaker of the Parliament of Zimbabwe, Advocate Jacob Francis Nzwidamilimo Mudenda met with a delegation of four members of Parliament at the Rashtrapati Bhavan. Zimbabwe is a country with bilateral trade opportunities in minerals, industrial development, pharma, agriculture, and mining. Recently an Indian delegation of IETO also visited Harare and Bulawayo. Notably, bilateral trade is valued at around $200 million USD.

Agriculture is a solution to reach a net zero economy

https://www.greenbiz.com/article/agriculture-solution-reach-net-zero-economy

More farmers are transitioning to climate-smart practices and the U.S. is recognizing the critical role

agriculture plays in driving climate solutions and strengthening the U.S. and global food systems. As a result, there will be significant opportunities to invest and help drive a climate-smart transition. The farmers who produce our food care about sustainability; it is their livelihood. In fact, farmers are the eco workforce who can have an impact on getting us closer to solutions for a net zero economy every day. They just need greater investment to employ the technologies that can catapult the transition. Institutional investors should see the promise of investing in agriculture as both an opportunity and potential alignment with their long-term sustainable investment goals.

Popularity of Daringbadi coffee growing rapidly

https://www.orissapost.com/popularity-of-daringbadi-coffee-growing-rapidly/

Daringbadi is gaining recognition for its coffee cultivation. To add to the success story, now the staterun coffee plantations are processing the seeds in the gardens itself. Earlier coffee seeds were collected from the plantations and sent to Koraput or Odisha University of Agriculture and Technology (OUAT) in Bhubaneswar for processing.

How crop diversification can benefit farmers, consumers and the environment

https://timesofindia.indiatimes.com/blogs/voices/how-crop-diversification-can-benefit-farmers-consumers-and-the-environment/

Out of the 6,000 plant species cultivated for food globally, 66 per cent come from just 9 species, according to a 2019 report of the Food and Agriculture Organisation (FAO). These include sugar cane, maize, rice, wheat, potatoes, soybeans, oil-palm fruit, sugar beet and cassava. Titled State of the World's Biodiversity for Food and Agriculture, the report highlights how the mass production of some crops, driven by global demands, is depleting the biodiversity of our agricultural landscapes. As major producers of wheat, sugarcane and paddy, Indian farmlands contribute to this trend, compromising biodiversity that could otherwise thrive in our tropical climate.

How does physical disturbance of soil impact carbon mineralisation?

Higher levels of potential carbon mineralisation (Cmin) in soil indicate that the soil is healthier. Many reports indicate that Cmin in agricultural soils increases with reductions in soil disturbance through tillage, but the mechanisms driving these increases are not well understood. The International Maize and Wheat Improvement Center (CIMMYT) has established a network of research platforms in Mexico, where collaborating scientists evaluate conservation agriculture and other sustainable technologies to generate data on how to improve local production systems.

An Introduction to Different Types of Yams

https://krishijagran.com/agripedia/an-introduction-to-different-types-of-yams/

Yams are tuber vegetables that are sometimes mistaken for sweet potatoes. Yams are less sweet and more starchy than sweet potatoes. Like sweet potatoes, they have white, yellow, purple, or pink flesh. The yam's ripeness affects its colour. While yellow, orange, and purple flesh yams are rich in antioxidants, complex carbs, and vitamins, white yams are strong in potassium. They provide several health advantages.

VF Foundation provides grant to support US Regenerative Cotton Fund

https://www.fibre2fashion.com/news/textile-news/vf-foundation-provides-grant-to-support-us-regenerative-cotton-fund-285128-newsdetails.htm

The VF Foundation, a global philanthropic arm of VF Corporation, has provided a grant to the US Regenerative Cotton Fund (USRCF) to catalyse the scaling of regenerative practices in the US. This farmer-facing, science-based initiative will help in promoting the adoption of soil health management systems across more than 1 million acres of US cotton cropland. The grant supports long-term, regenerative cotton production in the US, with the goal of eliminating one million metric tons of carbon dioxide equivalent (CO2e) from the atmosphere by 2026, the foundation said in a press release.

Punjab agriculture officials caution wheat farmers against yellow rust attack during cloudy and cold weather conditions

https://indianexpress.com/article/cities/chandigarh/punjab-agriculture-officials-yellow-rust-wheat-farmers-8372725/

ue to the prevailing cloudy and cold conditions over the past few days, the Punjab agriculture department has asked farmers to monitor their fields regularly for yellow rust, a fungal disease affecting crops during such weather. Experts said the disease is controllable if noticed in time and for that regular checking of fields is a must. Wheat varieties which are not replaced for long are also susceptible to the disease, they said. The sub-mountainous areas of Hoshiarpur, Gurdaspur, Nawanshahr and Ropar districts are more prone to this attack during the cloudy season.

Guyana offers 200 acres of land to India for production of millets for private sector

https://www.livemint.com/news/india/guyana-offers-200-acres-of-land-to-india-for-production-of-millets-for-private-sector-11673522402006.html

Guyana president Mohamed Irfaan Ali on Thursday offered 200 acres of land in Guyana to India for

cultivation and production of millets for private sector after UN declared 2023 as the International Year of Millet (IYOM). The Guyanese president made the offer in a meeting with agriculture minister Narendra Singh Tomar. “During the meeting, he asked the Indian minister to send a team of experts to set up millets farm in Guyana and promised all help in production and promotion of millets in the Caribbean and Latin American countries," said the Agriculture Ministry.

Workshop thrust on bringing out improved crop varieties

https://www.hindustantimes.com/cities/lucknow-news/workshop-thrust-on-bringing-out-improved-crop-varieties-101674069010237.html

The workshop aimed to provide a platform for all stakeholders to outline the opportunities in biofortified crops in eradicating malnutrition and deliberate on actions required at the policy and operational level to unleash the potential of biofortified crops in the country.

Centre to set up national level multi-state cooperative seed society

https://agrospectrumindia.com/2023/01/19/centre-to-set-up-national-level-multi-state-cooperative-seed-society.html

The Union Cabinet, chaired by the Hon’ble Prime Minister Narendra Modi, has approved a historic decision to set up and promote a national level multi-state seed cooperative society under Multi State Cooperative Societies (MSCS) Act, 2002 which will act as an apex organization for production, procurement, processing, branding, labelling, packaging, storage, marketing and distribution of quality seeds; strategic research & development; and to develop a system for preservation and promotion of indigenous natural seeds; through various cooperative societies across the country with support from relevant ministries especially Ministry of Agriculture and Farmers Welfare, Indian Council for Agricultural Research (ICAR) and national Seed Corporation (NSC) through their schemes and agencies following the ‘Whole of the Government Approach’.

Research News

Researchers Identify Genes to Help Fruit Adapt to Droughts

https://www.isaaa.org/kc/cropbiotechupdate/article/default.asp?ID=19915

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.

ARS Introduces Improved Winter Peas for Food Use

https://www.ars.usda.gov/news-events/news/research-news/2022/ars-releases-first-usda-winter-peas-for-food-not-feed/#:~:text=December%206%2C%202022%E2%80%94USDA%20MiCa,by%20the%20Agricultural%20Research%20Service

The USDA Agricultural Research Service released its first winter pea varieties developed for food use. The three new varieties released by USDA include- MiCa: A cross of a USDA winter pea with Arwyn, a spring pea with resistance to Pea Seed-borne Mosaic Virus that produces large, smooth green seeds. Dint: Produces large, smooth green seeds with a slight dimple. Klondike: Produces large, highly desirable dark yellow seeds invoked by the Klondike's connection to the gold rush era. Yellow seeds mean food producers don't have to remove color during processing.

Genome sequence of jackfruit decoded

The institutions are the Institute of Biotechnology and Genetic Engineering (IBGE), and Bangabandhu Sheikh Mujibur Rahman Agricultural University (BSMRAU), the Horticultural Research Centre, Bangladesh Agricultural Research Institute (BARI), the Global Institute for Food Security, University of Saskatchewan, University of British Columbia and National Research Council of Canada, said a press release.

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.

University Of Minnesota Investigates Data To Show Modern Wheat Varieties Are A Productivity And Biodiversity Win-Win

https://indiaeducationdiary.in/university-of-minnesota-investigates-data-to-show-modern-wheat-varieties-are-a-productivity-and-biodiversity-win-win/

In a paper recently published in the Proceedings of the National Academy of Sciences, researchers from the University's GEMS Informatics Center, Department of Applied Economics, and the Minnesota Supercomputing Institute assembled area data and the associated genetic pedigrees for the 1,353 commercial wheat varieties that made up most of the U.S. crop from 1919 to 2019. They factored in phylogenetic breadth when estimating both the spatial and temporal diversity of commercial wheat varieties found in fields, and tracked how that breadth changed over time across the country.

Transcriptomics and physiological analyses reveal that sulfur alleviates mercury toxicity in rice (*Oryza sativa* L.)

https://www.sciencedirect.com/science/article/abs/pii/S1001074223000050

Researchers from the Guangdong Academy of Sciences, China, and partners reported that sulfur alleviates mercury toxicity in rice. Their findings are published in the *Journal of Environmental Sciences*. Mercury contamination has caused a global concern because of its effects on human health when consumed through rice. Sulfur is vital for plant growth and may decrease mercury accumulation in rice grains. However, the specific impact of sulfur and the mechanisms involved in sulfur-mediated responses in mercury-stressed rice plants remain elusive. Thus, the researchers investigated the effects of sulfur on rice growth, mercury accumulation, physiology, and gene expression.

Gene Mechanism Affecting Rice Chill Tolerance Discovered

https://www.isaaa.org/kc/cropbiotechupdate/article/default.asp?ID=19966

For the first time, scientists document a domestication-selected DNA damage repair mechanism along with its corresponding elite modules involving chilling stress in rice. The findings are potentially valuable for molecular breeding research to develop chill-tolerant traits for crops. Using an approach that combined population genetics, genomics, and cell and evolutionary biology, experts from the Chinese Academy of Sciences conducted a data-merging genome-wide association studies based on multidimensional scaling. They identified a series of loci, one of which was the *qCTS11-1* on chromosome 11, that exhibited a clear contribution to rice chilling tolerance. Further mapping led to its major gene, *COLD11*.

Rice Breeding Breakthrough Could Help Feed Billions

https://www.isaaa.org/kc/cropbiotechupdate/article/default.asp?ID=19976

An international research team has successfully propagated a commercial hybrid rice variety as a clone through seeds with 95 percent efficiency. According to the team, this could lower the cost of hybrid rice seeds and make high-yielding, disease resistant rice varieties available to low-income farmers worldwide. Rice, the staple crop for half of the global population, is costly to breed as a hybrid for a yield improvement of about 10 percent. One of the solutions to this would be to propagate hybrids as clones that would remain identical from generation to generation without further breeding. Many wild plants can produce seeds that are clones of themselves, a process called apomixis. However, transferring apomixis to a major crop plant has proved difficult to achieve. In 2019, a team at the University of California Davis (UC Davis) led by Professor Venkatesan Sundaresan and Assistant

Professor Imtiyaz Khanday achieved apomixis in rice plants, with about 30 percent of seeds being clones. Sundaresan, Khanday, and colleagues in France, Germany, and Ghana have now achieved a clonal efficiency of 95 percent, using a commercial hybrid rice variety.