



Seed Connect

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Genomics-assisted breeding (GAB) was first presented as a concept in the 10th Anniversary Issue of Trends in Plant Science, *Feeding the World: Plant Biotechnology Milestones*, in 2005 and it has come a long way since then. Dr. Rajeev K Varshney, Director Research Program Genetic Gains, International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), Adjunct Professor, Murdoch University (Australia) and the lead author of the paper said that the team envisioned that GAB will be a game-changer for the development and delivery of high yielding improved crops varieties resistant to pest and disease, and abiotic stresses, and it was heartening to see it come to fruition from concept to product delivery.

With the development of more than 130 publicly bred cultivars of different crops, GAB is a promising technology that has shown success by expediting the timelines breeding progress across a broad range of crop species. The majority of the noteworthy crop products delivered by GAB applied in a variety of breeding programs include improved cultivars having elevated resistance levels against important diseases such as bacterial blight and blast in rice and rust in wheat (*Triticum aestivum*). Among biotic stresses, tolerance to submergence, salinity, and drought remained the key target traits for improvement using GAB.

Improved legumes and cereals with biotic stress resistance delivered through GAB

Rice	improved rice varieties with resistance to blast and bacterial blight disease
Wheat	improved varieties resistance to stress response and other agronomic and quality-related traits
Pearl Millet	improved variety with higher resistance to downy mildew
Barley	improved lines with resistance to eyespot, barley yellow mosaic viruses, and barley powdery mildew
Soybean	several soybean cyst nematode and multiple disease-resistant genotypes
Groundnut	introgression lines showing higher yield and increased rust resistance
Chickpea	high-yielding and Fusarium wilt and blight-resistant varieties

Abiotic stress resistance delivered through GAB

Rice	improved rice cultivars with QTL controlling submergence, salt and drought tolerance and gall midge resistance
Chickpea	improved drought tolerance variety 'Pusa 10216'

GAB for Quality/nutrition traits

Wheat	high grain protein content cultivars
Rice	improved fragrance and intermediate amylose content

Groundnut	varieties with improved oil quality - high oleic acid and resistance to nematode, rust and late leaf spot
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Dr Varshney says that these improvements happened just in a span of 15 years and now on 25th Anniversary Issue of Trends in Plant Science, together with scientists from the International Crops Research Institute for the Semi-Arid Tropics, Murdoch University (Australia), ICAR- Indian Institute of Pulses Research, Iowa State University (USA), Leibniz Institute of Plant Genetics & Crops Plant Research (Germany), Huazhong Agricultural University (China) and Cornell University (USA), has presented a comprehensive approach of designing future crops, in Cell Press entitled *Feeding the World: The Future of Plant Breeding*, and termed this approach as “genomic breeding” or genomics- assisted breeding (GAB) 2.0. In the coming decades, GAB 2.0 is expected to play a crucial role in breeding more climate-smart crop cultivars with higher nutritional value in a cost-effective and timely manner while ensuring sustainable and environmental protection.

This article on GAB 2.0 presents new approaches for developing designer crops and provides a road map to deploy one or more than one of the following approaches- marker-assisted selection, marker-assisted backcrossing, marker-assisted recurrent selection, haplotype-based breeding, promotion/removal of allele through genome editing, genomic selection in combination with speed breeding.

Development of such disease resistant, pest-resistant, abiotic stress tolerant and better quality/nutrition varieties through GAB 2.0 is also expected to reduce application of pesticides, insecticides and fertilizers in growing these varieties. At the same time, such varieties are also expected to deliver higher produce to farmers while ensuring sustainable agriculture and environmental protection. Through this advancement, the plant breeding community will continue to be armed not only with a vast array of data but also with the proper tools and technologies to decipher and implement the knowledge to feed a growing world.

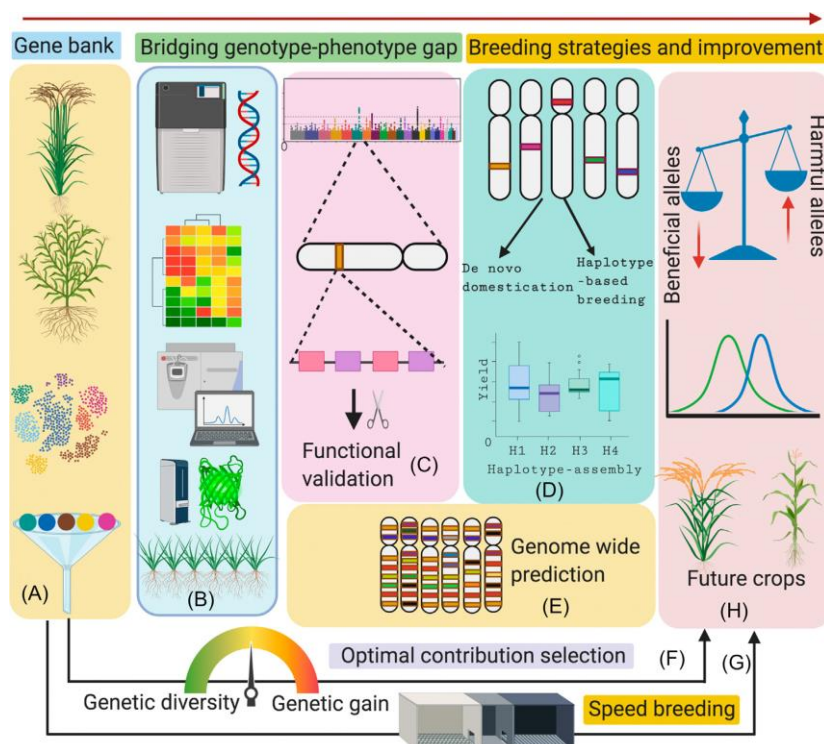


Figure 1: An Overview of Genomics-Assisted Breeding v 2.0 (GAB 2.0) to Deliver Future Crops. ([Varshney et al. 2021 Trends in Plant Science](#))

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



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

News from India and Around the World

[India begins exports of organic millets grown in Himalayas to Denmark](#)

(ANI)

India has begun exporting millets sourced from farmers in Uttarakhand, which meet the organic certification standards of the European Union, to Denmark. According to a release from the Ministry of Commerce & Industry, APEDA, in collaboration with Uttarakhand Agriculture Produce Marketing Board (UKAPMB) and Just Organik, an exporter, has sourced & processed ragi (finger millet), and jhingora (barnyard millet) from farmers in Uttarakhand for exports.

[Department Committed To Safeguard Farmers' Interests: Director Agriculture](#)

(India Education Diary)

In order to ensure the availability of different agricultural inputs (seeds, fertilizers, pesticides etc.) and to take on field assessment of different agricultural activities, Director Agriculture Kashmir Chowdhary Mohammad Iqbal visited different areas of Srinagar district. During the visit Director Agriculture said special times need special approach. He asked the officers and field functionaries to work in more professional and coordinated manner during these testing times. He impressed upon the concerned officers and functionaries while following COVID protocol in letter and spirit to reach out to the farmers and address their issues so that their interests could be safeguarded in the best possible manner. He said that chasing the target of doubling the farmers income by the year 2022 therefore need was to take all possible steps and interventions to realize this dream.

[Activate agriculture advisory boards: CM](#)

(The Times of India)

Chief minister YS Jagan Mohan Reddy directed officials to activate agriculture advisory boards and create awareness among board members about supporting farmers at all points of the crop cycle starting from crop planning. At the meeting, the chief minister reviewed the distribution of PDS rice and procurement of paddy at farm gates through Rythu Bharosa Kendras (RBKs).

[India seen keeping lid on global rice prices with record exports](#)

(Mint)

The world's biggest rice exporter is heading for record shipments this year that will help to keep rising food prices in check, according to the United Nations' Food and Agriculture Organization. Indian exports of the planet's most consumed staple may climb to an all-time high of 16.2 million tons this year, up about 12% from 14.5 million tons in 2020, said Shirley Mustafa, a Rome-based senior economist at the UN agency.

[Gujarat: Rs 1,085 crore loss to agriculture, horticulture](#)

(The times of India)

According to the preliminary assessments of the Gujarat government, Tauktae has caused a loss of over Rs 1085 crore to horticulture and agriculture in the state. The bulk of the damage to agriculture and horticulture has occurred in four districts of Saurashtra-Gir-Somnath, Junagadh, Amreli and Bhavnagar. However, other districts have also reported significant losses.

[IIT Ropar Invites Applications for 100 Online Internships in Technovations in Agriculture and Water, Stipend Rs 10,000](#)

(Data Quest)

IIT Ropar, in the framework of National Mission on Interdisciplinary Cyber-Physical Systems (NM ICPS) has launched an eight-week online internship carnival based on the theme 'Technovations in the domain of Agriculture and Water'. There are a total of 100 internships available, for which selected interns will be paid Rs 10,000 for the entire duration of the internship. A team of 5 students will be formed from the shortlisted students who will be required to work together on the designated project. There will be 10 winning teams, and one team will be selected from the two teams working on the same project on the basis of the comprehensive solution offered by the team, says IIT Roorkee.

[Agricultural exports zoom 17.5% in 2020-21, Pandemic raises questions on repeat performance this year](#)

(The Indian Express)

India's agricultural exports grew 17.5 per cent to cross \$41.8 billion in 2020-21. This came even as the country's overall merchandise exports fell 7.2 per cent to \$290.8 billion, from \$313.4 billion in 2019-20. The farm sector's standout export performance, the best since the \$43.25 billion of 2013-14, was thanks to a good monsoon, agriculture production being relatively unaffected by the Covid-19-induced lockdown, and a steep surge in global commodity prices. It is also in line with GDP numbers: Agricultural growth for 2020-21 is estimated at 3 per cent, even as the Indian economy contracted by 6.5 per cent.

[Agriculture Ministry formulates special Kharif strategy for ensuing Kharif season to attain self sufficiency in production of pulses](#)

(Newonair)

The Ministry of Agriculture has formulated a special Kharif strategy for implementation in the ensuing Kharif 2021 season with an aim to attain self-sufficiency in the production of pulses. Under the strategy, utilising all the high yielding varieties of seeds that are available either with the Central Seed Agencies or in the States will be distributed free of cost to increase area through intercropping and sole crop. For the coming Kharif 2021, it is proposed to distribute more than 20 lakh mini kits of seeds amounting to nearly Rs 82 crore. It is ten times more than last year. The total cost for these mini-kits will be borne by the Central Government to boost the production and productivity of tur, moong and urad. The move will cover over four lakh hectare area across the country. The Ministry of Agriculture in a statement said that for effective implementation of the Kharif mini kit programme, a massive outreach with the concerned districts will be held.

[India predicts another agricultural expansion](#)

(Hindustan Times)

India has forecast an expansion of agriculture despite a massive surge in Covid-19 numbers, as farmers are projected to raise output to record levels in the oncoming kharif or summer-sown season, following a pandemic-defying performance in 2020. The Union government is anticipating an increase

in sowing and higher demand from the farm sector. It has issued instructions for the seamless availability and supply of critical inputs, such as fertilisers, seeds, pesticides, and machinery. Millions of farmers have worked hard to keep agricultural operations going throughout the pandemic, aided by an exemption of the farm sector from Covid-related restrictions.

[Shakuntala Haraksingh Thilsted of Indian descent wins World Food Prize 2021](#)

(Outlook India)

Dr Shakuntala Haraksingh Thilsted, a global nutrition expert of Indian descent, won the prestigious 2021 World Food Prize for her ground-breaking research in developing holistic, nutrition-sensitive approaches to aquaculture and food systems. World Food Prize Foundation President Barbara Stinson announced the award, which is also referred to as the Nobel Prize for Food and Agriculture. The award also carries a cash prize of USD 250,000. US Secretary of State Antony J. Blinken, US Secretary of Agriculture Thomas J. Vilsack and UN Nutrition Chair Naoko Yamamoto delivered individual remarks at the announcement. Thilsted's trailblazing research on small native fish species in Bangladesh led to the development of nutrition-sensitive approaches to aquatic food systems at all levels, from the farm to food processing to final consumers, resulting in improved diets for millions of the most vulnerable people in Asia and Africa.

[Harnessing agriculture as tool of women empowerment](#)

(SME Futures)

It will startle many to know that as much as 80 per cent food produced is done by women working in the agriculture sector. While they are present at all levels of the value chain – pre-harvest, production, post-harvest, processing, packaging, and marketing – labour-intensive sowing, transplanting, and weeding are heavily dependent on them. The Economic Survey 2017-18, interestingly, pointed at the 'feminisation' of the agriculture sector, noting that with growing rural to urban migration by men, an increasing number of women are assuming multiple roles as cultivators, entrepreneurs, and labourers.

[Odisha government to procure pulses, oilseeds from May 13](#)

(The New Indian Express)

The State government will start procurement of oilseeds and pulses at minimum support price (MSP) from farmers starting May 13. The Ministry of Agriculture, Cooperation and Farmers Welfare has approved the State government's proposal for procurement of 13,225 tonne green gram (moong), 700 tonne black gram (biri), 7,775 tonne groundnut pods and 675 tonne sunflower seeds at MSP announced by the Centre for 2021-22 rabi season to save farmers from exploitation by middlemen.

[Retired Andhra Banker Solves His Village's Water Crisis, Transforms 800 Acres Of Land](#)

(The Better India)

In 2018, S Venkateswara Reddy from Hyderabad retired as a banker from the State Bank of India. As he relieved himself from the first innings of life, he planned to try his second stint with farming. But things didn't turn out to be as easy as they seemed. Venkateswara returned to ancestral land in Mallepalle village, only to find that the prospects looked bleak. The Ville fell in the Rayalaseema region, a drought-affected region of Andhra Pradesh. "I had decided to grow vegetables and other crops on the 10-acre land. But when I reached the village and spoke to the farmers about procuring resources, I faced a massive challenge. The villagers informed that there had been no water in the area for over a decade." Moreover, he learned that the farmers could hardly take one crop a year. "The agriculture depended entirely at the mercy of rains. No rains and no crops had become a normal practice," he says. At present, Venkateswara has not only solved his own water crisis, but also benefited 30 farmers with the help of canal irrigation. The move allows them to take two and sometimes even three assured crops on 800 acres of land a year.

[Canadian geothermal project explores agriculture opportunity](#)

(Think GeoEnergy)

A Korean B2B company recently closed a deal to buy a container full of amla powder from an unidentified Indian seller, indicating that gooseberries grown in India are making their way to Korea as immunity boosters in these troubled times. This is the first amla export from India to South Korea. The global amla extract industry, which was estimated at \$35.39 billion in 2018, is forecast to develop

at a CAGR of 4.9 percent between 2019 and 2025, according to a study by market research company Grand View Research. This expansion is fueled primarily by rising health awareness and increased demand for antioxidant-rich goods.

[India, Israel sign agreement on agriculture cooperation](#)

(The Indian Express)

India and Israel have signed “a three-year work program agreement” for development in agriculture cooperation, the Ministry of Agriculture and Farmers Welfare said. “Taking forward the ever-growing partnership in agriculture between Israel and India, the two governments have agreed to enhance their cooperation in agriculture and signed a three-year work program agreement for development in Agriculture cooperation, while affirming the ever-growing bilateral partnership and recognizing the centrality of agriculture and water sectors in the bilateral relationship,” the Ministry said in a statement.

[First consignment of GI certified Shahi Litchi from Bihar exported to UK: Commerce ministry](#)

(The Economic Times)

India exported the season's first consignment of Shahi Litchi from Bihar to the United Kingdom by air route on Monday, the commerce ministry said. It was a GI-certified product. The GI tag helps growers get premium price of the product as no other producer can misuse the name to market similar goods. A geographical indication (GI) tag is used for an agricultural, natural or a manufactured product (handicraft and industrial goods) originating from a definite geographical territory. Typically, such a name conveys an assurance of quality and distinctiveness, which is essentially attributable to the place of its origin.

[Typically, such a name conveys an assurance of quality and distinctiveness, which is essentially attributable to the place of its origin](#)

(Mint)

Alphonso, Kesar, Totapuri and Banganpalli are leading export varieties from India. Mango exports primarily take place in three forms: fresh mango, mango pulp, and mango slice. Mangoes are processed by the APEDA registered packhouse facilities and then exported to various regions and countries. Earlier this month, for the first time in this season, India shipped a consignment of 2.5 Metric Tonne (MTs) of Geographical Indication (GI) certified Banganapalli and Survarnakha mangoes to South Korea sourced from farmers in Krishna and Chittoor districts of Andhra Pradesh.

[Farmers warned of possible locust attack in UP's Aligarh](#)

(India Tv)

As Uttar Pradesh is struggling to tackle the Covid-19 pandemic as well as the emergence of black fungus cases, the possibility of a locust attack also looms large. The Aligarh District Administration has now sounded an alert over a likely locust attack. Officials have issued the advisory after swarms of locusts were spotted in Rajasthan's Jaisalmer city. The state's Agriculture Department has geared up and remains vigilant. Farmers have also been warned on the issue, desert locusts that move in large swarms, can consume crops up to their own weight every day.

[Rajasthan: Agriculture body wins India Biodiversity Awards](#)

(The Times of India)

Krishi Avam Parishthitiki Vikas Sansthan (KRAPAVIS) has won the prestigious India Biodiversity Award 2021 under the category ‘Sustainable use of biological resources’. The award was announced on the occasion of International Biodiversity Day by the Union Environment Minister in a virtual celebration. On receiving the award, KRAPAVIS founder Aman Singh said, “Our two-and-a-half-decades work has involved restoring hundreds of Orans, which are the ‘natural commonlands’ where one can find water, medicinal plants, wild foods, wildlife but also solace and spiritual comfort. In our work, we use the ‘citizen science’ research & documentation; policy analysis and advocacy; and above all the community awareness.”

[Need to cut incentives for paddy cultivation: Siraj Hussain, former agriculture secretary](#)

(The Financial Express)

The rural areas in several states are indeed reeling under the onslaught of the epidemic. The bad news is that there is a huge gap in vaccination between urban and rural areas, except in Gujarat, Kerala and Rajasthan. There is ample availability of agricultural labour due to migration. If the Covid-19 situation starts improving and the element of fear is checked by a lower number of cases and higher vaccination, the kharif sowing operations are not likely to affect adversely. Monsoon will hit north-west only in early July, by then the wave is likely to subside.

[Plague of ravenous, destructive mice tormenting Australians](#)

(Toronto Star)

Vast tracts of land in Australia's New South Wales state are being threatened by a mouse plague that the state government describes as "absolutely unprecedented." Just how many millions of rodents have infested the agricultural plains across the state is guesswork. "We're at a critical point now where if we don't significantly reduce the number of mice that are in plague proportions by spring, we are facing an absolute economic and social crisis in rural and regional New South Wales," Agriculture Minister Adam Marshall said this month. Bruce Barnes said he is taking a gamble by planting crops on his family farm near the central New South Wales town of Bogan Gate. "We just sow and hope," he said.

[Business groups: Open agriculture trade to ensure food stability](#)

(Phil Star)

The local agriculture sector should be more open to foreign trade to ensure that food is available and affordable for all Filipinos, following the continued conflict over lower import duties on some commodities, business groups said. In a joint statement, seven large organizations maintained that the country's farm sector should be more welcoming to foreign trade and investments. They said that such an open trade stance would help keep food affordable and safe and would also strengthen the capability of creating jobs for the rural population. The groups consist of the American Chamber of Commerce of the Philippines Inc., Cold Chain Association of the Philippines Inc., Federation of Filipino-Chinese Chambers of Commerce and Industry Inc. and Fisheries and Aquaculture Board.

New Research

[The new species of bacteria killing palms in Australia](#)

(Phys.org)

As reported in the International Journal of Systematic and Evolutionary Microbiology, a newly discovered bacterium named *Candidatus phytoplasma dyspidis* has been found to cause a fatal wilt disease. In 2016, several ornamental palms within a conservatory in the Cairns Botanic Gardens, Queensland, died mysteriously. A sample was taken from one of the diseased plants and investigated by Dr. Richard Davis and colleagues from the Australian Government Department of Agriculture, Water and the Environment, and state and local government. They compared the characteristics and genome of the bacterium identified as the cause of the disease and found the bacterium was similar to other species of *Candidatus phytoplasma*, many of which are responsible for disease epidemics in palms elsewhere but was different enough to be an independent species. "When the laboratory testing indicated it was something close to, but not the same as, devastating palm pathogens overseas, we were very surprised," said Dr. Davis.

[Invasive species costing Africa \\$3.66 tn a year: study](#)

(Phys.org)

Invasive species introduced by human activity are costing African agriculture some \$3.66 trillion every year—around 1.5 times the combined gross domestic product of all African countries—new research showed. Non-native species of weed, insect or worm can have catastrophic effects on farming, with just a single bug capable of reducing yields of staple crops across the continent. Now researchers based in Ghana, Kenya, Britain and Switzerland have sought to estimate the annual economic hit caused by invasive species to African agriculture. The team studied open source and peer-reviewed literature on species that were not native to the continent but had caused crop losses to assess the economic impact on yield, management and the cost of research.

[Tiny tomatoes could mean big profits for urban agriculture](#)

(UC Riverside)

Urban agriculture offers many benefits for food production but often has higher costs relative to traditional farming and is limited to only a few crops. Robert Jinkerson, an assistant professor of chemical and environmental engineering at UC Riverside, is working to change this by engineering the size and nutritional value of tomato plants to increase both the diversity and value of crops that can be grown in urban controlled environment agriculture, or CEA. Jinkerson has received a \$450,000 New Innovator grant from the Foundation for Food & Agriculture Research, or FFAR, to advance this research. FFAR's New Innovator in Food & Agriculture Research Award provides early career scientists with funding to conduct audacious food and agriculture research.

[AWARD invests in gender responsive research to boost African agriculture](#)

(KBC Channel)

The report, Agspirations: Inspiring stories of African agriculture, volume 1, is published by African Women in Agricultural Research and Development (AWARD). This publication highlights how addressing gender gaps in agricultural research and science, technology, engineering and mathematics (STEM), and overcoming inequalities in access to innovations between men and women, benefits small-scale farmers and the attainment of sustainable agriculture. Less than a quarter of agricultural researchers in sub-Saharan Africa are women and only 14 per cent of those in leadership positions in agricultural research are women, according to 2017 research commissioned by AWARD. Further, women account for less than 16 percent of the research labor force in agricultural sciences in francophone African countries.

[National Research Council of Canada announces funding support for Canada-UK collaboration projects focussed on sustainable agriculture](#)

(News Wire)

The National Research Council of Canada (NRC) is pleased to announce that 7 Canadian firms have been approved to pursue collaborative projects with UK partners through the Canada-UK industrial research and development call for proposals delivered by the NRC and UK Research and Innovation (UKRI). The successful projects are focussed on improving productivity and sustainability in the agricultural industry, including crop, livestock, and/or aquaculture systems using precision and data-driven solutions. The National Research Council of Canada Industrial Research Assistance Program (NRC IRAP) is providing advisory services and up to \$2.9 million in research and development funding to support 7 collaboration projects.

[Fluorescent light clarifies relationship between heat stress and crop yield](#)

(Science Daily)

Scientists report that it is possible to detect and predict heat damage in crops by measuring the fluorescent light signature of plant leaves experiencing heat stress. If collected via satellite, this fluorescent signal could support widespread monitoring of growth and crop yield under the heat stress of climate change, the researchers say. Their study measures sun-induced chlorophyll fluorescence -- or SIF -- to monitor a plant's photosynthetic health and establish a connection between heat stress and crop yield. The findings are published in the journal Global Change Biology.
