BORLAUG INSTITUTE FOR SOUTH ASIA (BISA)

TRANSFORMING THE LIVES OF SOUTH ASIAN FARMERS

ANNUAL REPORT 2021

BISA Borlaug Institute for South Asia

CIMMYT International Maize and Wheat Improvement Center

भाकृअनुप ICAR

Annual Report covering all the aspects of research programs implemented by the Borlaug Institute for South Asia (BISA) in the financial year 2020-2021.
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ABBREVIATIONS

BARC	Bhabha Atomic Research Centre
BISA	Borlaug Institute for South Asia
CRA	Climate-Resilient Agriculture
CSAP	Climate Smart Agricultural Prioritization
CSV	Climate Smart Village
CA	Conservation Agriculture
DBT	Department of Biotechnology
FGDs	Focus Group Discussions
GEI	Gender Empowerment Index
GEBVs	Genomic-Estimated Breeding Values
ICAR	Indian Council of Agricultural Research
CIMMYT	International Maize and Wheat Improvement Centre
IIWBR	Indian Institute of Wheat and Barley Research
KUSUM	Kisan Urja Suraksha Evam Utthan Mahaabhiyan
NDVI	Normalized Difference Vegetation Index
PAU	Punjab Agriculture University
SABWGPYT	South-Asia Bread Wheat Genomic Prediction Yield Trial
SDGs	Sustainable Development Goals
SPIS	Solar Powered Irrigation System
TPEs	The Target Population Of Environments

ABOUT BISA

The Borlaug Institute for South Asia (BISA) is a non-profit international research institute jointly established in October 2011 by the International Maize and Wheat Improvement Centre (Spanish acronym, CIMMYT) and the Indian Council of Agricultural Research (ICAR), New Delhi, to implement the vision of Norman E. Borlaug for combating hunger through applied science and improved policy. BISA enhances and promotes farm productivity, food and nutritional security, rural livelihoods, and environmental rehabilitation to invigorate the agriculture and food systems and help meet present and future demands for food in South Asia, home to more than 300 million undernourished people. The Institute harnesses the latest genetic, digital, and resource management technologies, as well as advanced research-for-development findings, and enables partners and stakeholders to leverage, adapt, and share the best international and regional science for rapid increases in the productivity, profitability, and sustainability of South Asia's bread baskets.

BISA impact pathways, thematic areas, and overall approach

Thematic activities	Outputs	Research partners and next users	Outcomes	Impact
Genetic Enhancement Climate action Sustainable Intensification Digital agriculture Capacity strengthening	**Scientific research** Genetic enhancement Resource conservation technologies Digital tools Peer-reviewed research papers **Policy impact** Policy briefs Climate-smart finance plans **Capacity enhancement** Training modules Communication products South: South learnings	Farmers and FPOs Village Leaders NGOs Agri and food industry ICAR CIMMYT Other CG centres NARS Gov agencies (e.g. MET) SAARC/ BIMSTEC	Large-scale adoption of improved varieties, machinery, CSA and insurance products Innovative PPP models lead to increased investment in agriculture Increased research for development capacity	Higher food security Improved rural livelihoods Increased climate resilience Efficient use of natural resources Effective Public-private partnerships

BISA BY THE NUMBERS IN 2021

>50,000
plots on 34 hectares
BISA grew one of the largest yield trials in South Asia

All field data covering 472 ha of BISA farm have been fully digitized.

Wheat trials in BISA locations have achieved grain yields of 10 tons per hectare.

More than 50 national partners visited BISA farms to select germplasm.

More than 20,000 packets of seed of elite breeding lines were distributed to national partners.

New wheat genotype PBW 869 made available, for early sowing in Punjab.

Use of the Happy Seeder, a zero-tillage sowing implement, was shown to save as much as 32 litres of diesel per hectare.

11235.8 q seed of different crops produced & disseminated to stakeholders including 9750 q quality seed of wheat

483 participants benefited from BISA training on Solar Powered Irrigation Systems (SPIS).

>5,000 farmers and other stakeholders received training on different subjects at BISA farms.

MESSAGE

FROM CIMMYT DIRECTOR GENERAL AND BISA MANAGING DIRECTOR

Bram Govaerts
Director-General, CIMMYT-BISA

Arun Kumar Joshi
Managing Director, BISA

The year 2020-21 will go down in history. The world grappled with a titanic health and humanitarian crisis, bringing a sudden halt to many human activities, huge challenges, and cascading impacts on individuals and critical segments of societies. The pandemic caused a 30% rise in global food prices and a sharp decline in the incomes of smallholder farmers and their households, bringing agriculture to the forefront of policy and development discussions.

In India, agriculture activities were deemed "essential services" and not subject to pandemic-related restrictions. However, general lockdowns restricted the movement of persons, making field operations impossible and preventing farmers from sowing their crops, causing large-scale disruptions in agriculture value chains that dampened rural economies and triggered reverse migration.

Faced with many challenges and leveraging global concerns about food systems, BISA resolutely fostered a wave of research-for-development innovations able to transform future agriculture, many of which are documented in scientific publications and media reports. Farm and facility operations continued apace with online support and the Institute prioritised partners' ready access to seed of select breeding lines. Reflecting its strong commitment to capacity-building, BISA organised training events to connect farmers with valuable technology and practices, as well as pursuing regional and local activities in support of students and scholars. In conjunction with ICAR and other Indian stakeholders, BISA contributed to national agriculture research with evidence-based recommendations.

All this would not have been possible without the strong vision and outstanding governance provided by the CIMMYT-BISA Board, and especially the generous and farsighted financial support of our funders.

On behalf of the millions of farmers and consumers who draw benefits and hope from BISA's efforts, we are grateful for your interest and support. We especially take pride in our staff and their valuable contributions to BISA and hope they continue with the same enthusiasm to take the Institute and its crucial work to new and more significant heights in the coming years.

BISA research farm at
Jabalpur, Madhya Pradesh

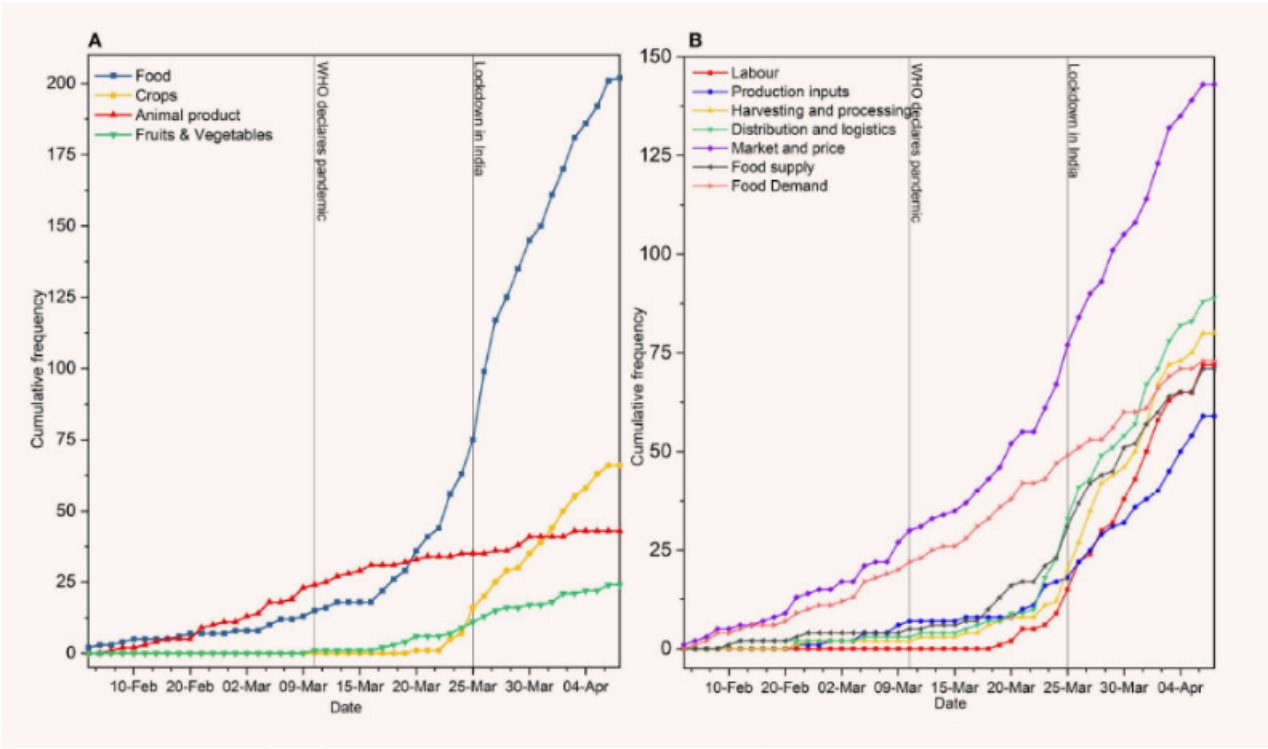
EARLY IMPACTS OF COVID-19 ON FOOD SUPPLY CHAINS

A study led by BISA and the CGIAR Research Program on Climate Change, Agriculture, and Food Security (CCAFS) used news mining and content analysis of media articles published from February to April 2020, to assess the early impacts of the COVID-19 pandemic on the food supply chains and farm household distress in India. It also presented media perceptions regarding the pandemic and resulting policy measures, using sentiment analysis and the cross-tabulation of results that show differential impacts across food supply chain components across commodity groups and regions.

ASSESSING THE RISKS AFFECTING THE FOOD SUPPLY CHAIN.

The study found broad impacts across the food supply chain, from crop harvesting and processing, distribution, and logistics to food markets. Outcomes differed by commodity group, with animal products — particularly poultry — having more trade and demand-side issues and fruits and vegetables constrained by logistical bottlenecks. For major crops, labour scarcities affected farm operations, including harvesting. News reports showed a spike in negative sentiment following the national lockdown, with relatively less negativity in subsequent weeks due to large-scale policy and community action. Particularly negative responses resulted from falling consumer demand and prices for chicken, due to rumours about COVID being spread through poultry, as well as the overall lack of food supplies and market shut downs. Farmers faced multiple pandemic-related risks and extreme weather in many parts of India. The study results highlighted the importance of building resilient food systems, especially when the biotic and abiotic shocks are projected to increase globally due to biodiversity loss and climate change.

Time series of cumulative frequency of articles by (A) commodity and (B) supply chain component.



WOMEN AND MEN'S EMPOWERMENT IN CLIMATE-SMART VILLAGES OF NEPAL

BISA implemented the Climate-Smart Village (CSV) project with the organization Local Initiatives for Biodiversity, Research and Development (LI-BIRD) to reduce the negative impact of climate on Nepal agriculture. The project tested and identified a portfolio of promising climate-smart technologies and practices through demonstrations, visits, and training events in communities in a range of agroecologies. As part of the initiative, the CSV conducted surveys in 160 households, as well as focus group discussions, in four project and non-project villages representing diverse ecologies of Nawalpur and Bardiya districts, to understand women and men's empowerment.

Gender empowerment for both men and women was significantly higher in project villages of both districts, indicating that the CSV approach had brought changes in households' knowledge and capacity. The status of women was higher in more prosperous households in all villages, indicating that the enhanced participation of women in agriculture and economic activities contributed to equality. The study generated an empowerment index from scores for political, economic, social, and agriculture empowerment subtracted the index value of women from that of men, and classified womens' empowerment as less than, equal to, or greater than that of men.

BUILDING **CLIMATE-RESILIENT AGRICULTURE** IN SOUTH ASIA

SMALL-SCALE FARMERS IN MARGINAL SETTINGS ARE ESPECIALLY VULNERABLE TO CLIMATE CHANGE AND EXTREME WEATHER EVENTS.

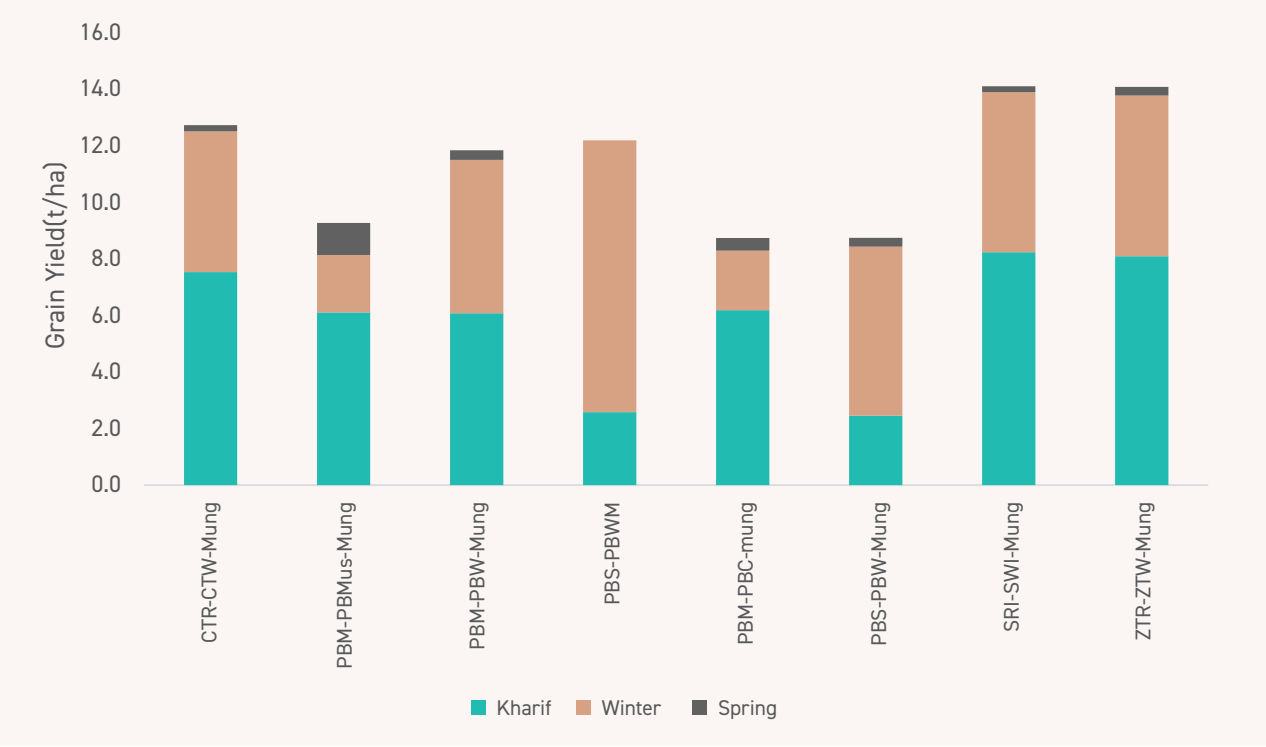
Locally suited, climate-resilient crop varieties, along with improved sowing methods, mechanization, and weather information, help to mitigate farmers' risks and costs. BISA and partners have developed several cropping systems and technologies to fit diverse agroecologies and cropping systems, supporting the sustainable intensification of those systems for farm productivity and profitability.

Diversifying rice-wheat cropping with rotations involving maize, mustard, mung bean, and soybean has provided notable benefits, with profitable yields of alternative crops such as mustard, which in one system was harvested early to allow early planting of mung bean. Farmer adoption of rice varieties that mature more quickly, as well as sowing rice and seed of the following wheat crop directly into unplowed fields — a practice known as zero-tillage — enables the early establishment of wheat crops, critical so that grain filling occurs before the extreme heat of the pre-monsoon season.

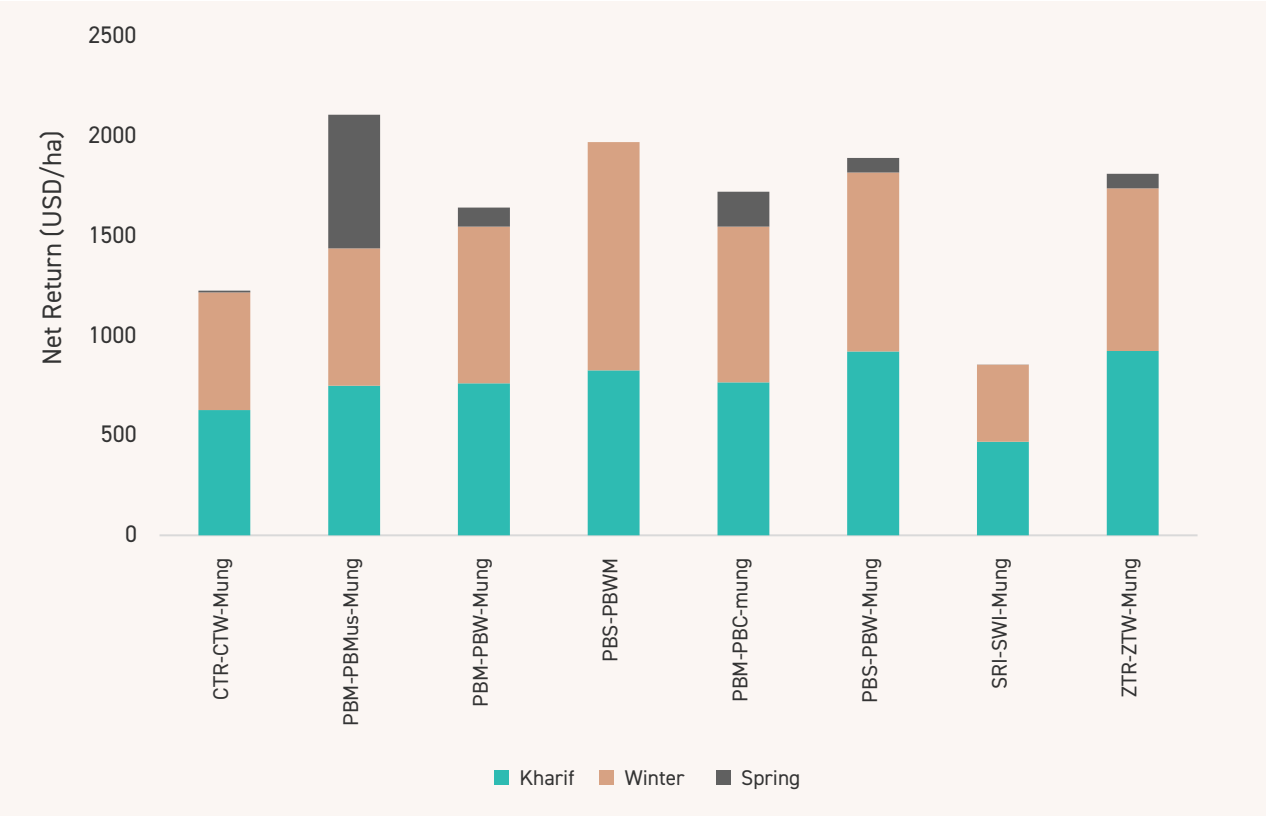
A range of wheat management practices, including crop residue mulching, potassium applications during grain filling, and light irrigation, have been shown to mitigate late season heat on wheat. Growing crops on raised soil beds helps prevent waterlogging during the monsoon season and are well suited for maize — with yields 50% higher during that period than those of maize grown in normal rows — as well as for soybean and other upland crops.

In addition to the above, legume-based cropping, land levelling for even distribution of irrigation water, and precise management of crop nutrients all enhance resource use efficiency, allowing farmers to grow more with less. In the case of nitrogen fertilizer, reduced applications mean fewer emissions of greenhouse gases. Continuous no-till and crop residue retention improves the quality and quantity of soil organic carbon, boosting soil health.

Based on its long-term research experience and expertise in climate-resilient agriculture, BISA has attracted local farmers and policy planners to show them the potential advantages of these practices. In partnership with the Indian Council of Agricultural Research (ICAR), CIMMYT, and state governments and agricultural universities, BISA has implemented crucial research projects on climate-resilient agriculture, with funding from the government of Bihar and India's Department of Agriculture and its Ministry of Environment, Forest and Climate Change.



The high productivity and profitability of innovative cropping systems for the Indo-Gangetic Plains.



MULTI-TRAIT AND MULTI-ENVIRONMENT WHEAT PHENOTYPING

WHEAT BREEDERS' HOME IN ON THE BEST EXPERIMENTAL WHEAT LINES FOR KEY TRAITS, WITH THE SUPPORT OF ROBUST, PRECISE, AND LARGE-SCALE FIELD MEASUREMENTS IN DIVERSE ENVIRONMENTS

Tools for precision phenotyping:
A Phenocart (Up) and a Drone (down)

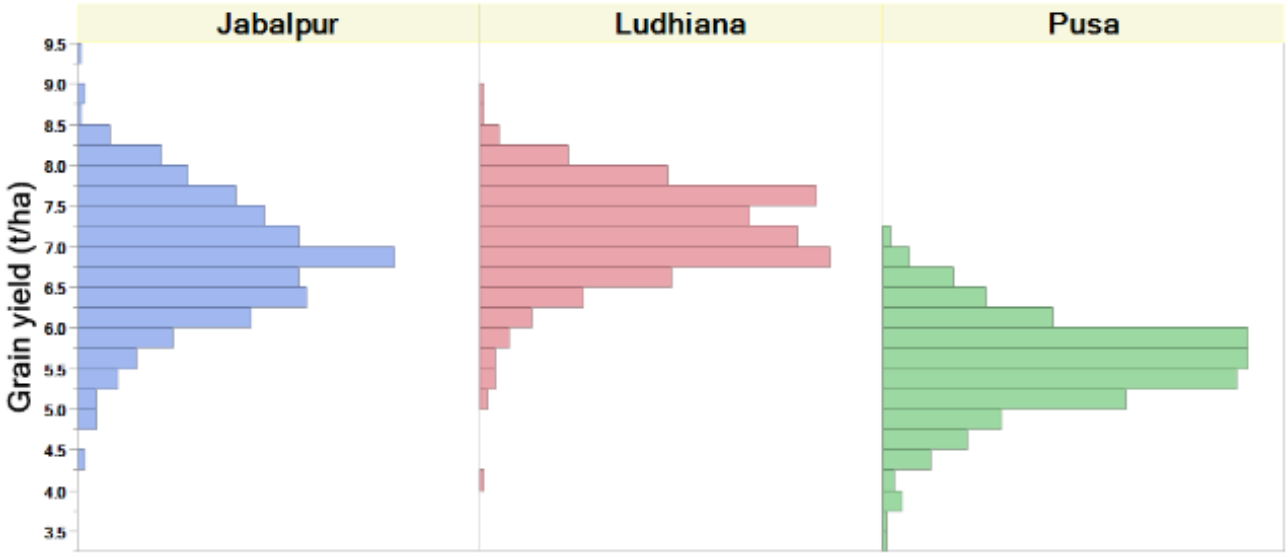
BISA has greatly increased the land used for wheat "phenotyping" — which means the precise and, often, technology-aided recording of the field performance of experimental lines for key traits — going from 6,600 plots in 2015 to more than 50,000 in 2021 for yield trials this year.

The Institute phenotyped nearly 2500 advanced breeding lines obtained from CIMMYT, Mexico, at Jabalpur, Ludhiana, and Pusa for resistance to stripe rust and spot blotch and grain yield under early and terminal heat stress conditions of India. High yields (up to 9.4 tons per hectare) were obtained in Jabalpur and several lines were tagged for advancement to target sites or further use in CIMMYT's global wheat program.

BISA also grew and phenotyped the lines in the South-Asia Bread Wheat Genomic Prediction Yield Trial (SABWGPYT), generating more than 47,500 data points for traits including germination percentage, ground cover, days to booting, days to flowering, days to maturity, flag leaf length and width, peduncle length, plant height, spike length, lodging, and thousand-grain weight. To identify superior, high-yielding, and heat-tolerant lines from the 2018-19 and 2019-20 versions of the trial, BISA scientists evaluated a selection of more than 100 lines under normal and late sowing (the latter with heat stress), at all three sites.

PRECISION PHENOTYPING TOOLS

Modern phenotyping tools, such as the phenocart with digital cameras and unmanned aerial vehicles with remote sensors, measured growth, and indicators such as the normalized difference vegetation index (NDVI) and canopy temperature at all BISA sites during ground cover, booting, heading, anthesis, milking, and maturity stages, generating over 39,000 data points for genomic prediction models for grain yield. All field data collection was digital, using barcode scanners and the Field Book data collection application, and operations were mechanized to enhance precision.



ACCELERATING THE ACCESS OF

NATIONAL AGRICULTURAL RESEARCH SYSTEMS TO IMPROVED WHEAT GERMPLASM

BISA HAS GOTTEN IMPROVED BREEDING LINES FROM CIMMYT QUICKLY TO PARTNERS

Via field days and visits to BISA locations, the Institute shared with national research partners and other interested collaborators improved breeding lines and diverse wheat genetic resources from CIMMYT for the 2020-21 cycle, providing recipients with access two years earlier than if they had obtained the materials through international yield trials. More than 50 national partners visited BISA farms to select germplasm for use in their breeding programs. BISA also distributed more than 20,000 packets of seed of elite wheat lines in 2021 and, by way of a Department of Biotechnology (DBT) project, multiplied and distributed more than 200,000 packets of seed of assorted germplasm to 18 Indian partners engaged in wheat breeding.

ENABLING FAST-TRACK VARIETY TESTING AND RELEASE

Using the germplasm previously shared by BISA with national breeding programs, three new wheat varieties were released for early sowing conditions in the Northwest Plain Zone of India, with the variety DBW 303 becoming the first to exceed 8 tons per hectare in average grain yield, providing an excellent example of ICAR-BISA-CIMMYT collaboration. Under strategic research on genotype, environment, and crop management interactions to define climate-resilient systems in different ecologies, BISA identified wheat germplasm for early sowing through multi-location evaluations in three different ecologies. Five lines from heat stress tolerance trials contributed to the coordinated trial of the Indian Institute of Wheat and Barley Research (IIWBR), ICAR, for fast-track release.

To test selected high-yielding and yellow rust-resistant lines from the 2018-19 and 2019-20 collections, a set of 40 lines including genotypes suited to each wheat-growing zone was evaluated at all three BISA locations following farmers' practices, providing data for actual yield under farmer conditions and also producing seed for on-station and multi-location trials by partners. Seed of four entries was provided to Punjab Agricultural University (PAU)-Ludhiana, IIWBR-Karnal, and the Bhabha Atomic Research Centre (BARC)-Mumbai, saving those partners a full year in the variety release process.

In large-scale on-station and on-farm evaluations by BISA and PAU in 2020 and 2021, the new wheat genotype PBW 869 showed superior yields, bold grain, and strong resistance to leaf rust and was released in Punjab.

CIMMYT advance breeding lines seed packets preparation at BISA research farm in Ludhiana, Punjab.

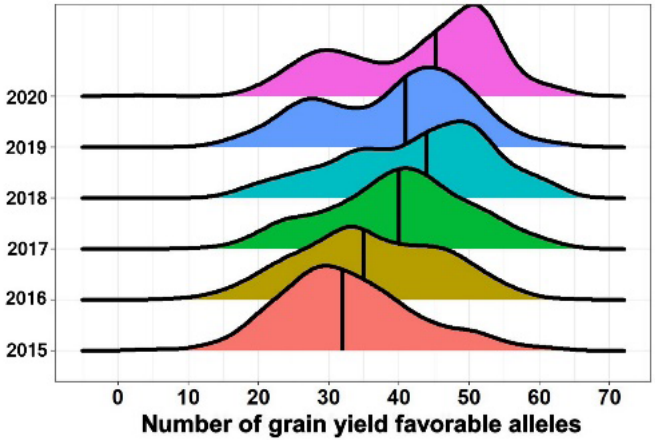
HARNESSING THE **POWER OF GENOMIC BREEDING**

GENOMIC BREEDING AND QUANTITATIVE GENETICS HELP TO INCREASE SELECTION ACCURACY AND REFINE TARGET POPULATIONS FOR ENVIRONMENTS

Genomic selection takes advantage of low-cost, genome-wide molecular markers to analyse large populations and allows scientists to predict the value, as future parents, of specific breeding lines and crosses. This helps to speed progress in breeding, especially for genetically complex traits such as yield. To increase the selection accuracy and enhance the rate of genetic gain for grain yield in the South Asia Target Population of Environments (TPEs), BISA has begun using grain yield genomic-estimated breeding values (GEBVs) routinely with phenotypic data and applying the combined information in decisions to advance promising lines. For this, 486 lines from SABWGPYT 2020-21 were genetically analysed in collaboration with Kansas State University's Applied Wheat Genomics Innovation Lab, providing useful GEBVs for grain yield in 8 South Asia sites. The GEBV values were shared with South Asian partners to help refine their wheat line choices. In addition, selection indices for grain yield in each TPE were used to guide similar decisions regarding the best lines for specific environments.

UNDERSTANDING THE GENETIC BASIS OF GRAIN YIELD

Genome-wide association studies (GWAS) involve rapidly scanning of molecular markers across complete sets of DNA for many breeding lines, to locate genetic variation associated with particular traits. A GWAS for grain yield in wheat lines grown across BISA sites from 2015 to 2020 identified



molecular markers, which are DNA "signposts" for traits, that were consistent across multiple locations and years. Genomic profiles of 3,229 SABWGPYT lines for 70 markers associated with grain yield will enable breeders to select parents, design strategic crosses, and eliminate lines with few or no favourable "alleles," which are variations of a gene. A retrospective analysis of the frequency of favourable alleles for grain yield in the SABWGPYT wheat lines over 2015-20 (see illustration) indicated excellent progress and scope for further enrichment using genomics-assisted breeding.

Marker-based trait heritability for grain yield in BISA and other South Asian sites was used to determine the response to selection and understand the portion of phenotypic variance that can be attributed directly to genetic variance. The genetic correlations between grain yield evaluated in BISA sites and South Asian target environments were used to understand the correlated response to selection and to better target lines to specific types of environments.

EFFICIENT CROP RESIDUE MANAGEMENT FOR SUSTAINABLE INTENSIFICATION

Current farming practices in rice-wheat cropping systems, the leading rotation in the northwest Indo-Gangetic Plains, are neither sustainable nor environmentally sound. They require large amounts of labour, water, energy, and chemical inputs, with low input-use efficiencies. Combine harvesters for rice and leave large amounts of stubble and straw in the field. Farmers typically burn millions of tons of rice residues each year to quickly clear fields for wheat planting, a practice that degrades soils, releases greenhouse gases, and generates massive, noxious clouds that affect cities such as New Delhi. In addition, rice is grown in puddled paddies. To sow wheat after rice, the soil structure is rebuilt through intensive tillage requiring as many as seven tractor passes, consuming copious amounts of diesel, and delaying wheat planting up to two weeks. Finally, farmers apply large doses of nitrogen in fertilizer to wheat crops, only a third of which is used by the plants. Nearly all remaining nitrogen leaches into groundwater or is emitted as nitrous oxide, a powerful greenhouse gas.

The harmful effects of conventional, tillage-based agriculture and residue burning can be addressed in large part through conservation agriculture, a set of practices based broadly on reduced or zero tillage, keeping crop residues on the soil, and the use of rotations and intercropping. Zero tillage and residue retention have long been promoted in the region, most recently for sowing wheat using the "Happy Seeder," a tractor-mounted implement perfected by BISA that cuts and lifts rice straw, places seed and fertilizer directly into the soil, and deposits the straw over the sown area as mulch. Large-scale demonstrations of the implementation of an innovative straw management system for harvesters have raised awareness among farmers, experts, and policymakers of these alternatives to burning rice straw and led to the development of a business case for promoting Happy Seeders in Punjab and Haryana. As part of this, 105 villages in 7 districts of those states were selected to pilot no-burn farming using Happy Seeders. A short video showed rice harvesting operations using a combine harvester fitted with a straw management system and simultaneous seeding of wheat using the Happy Seeder was shown to a large audience of farmers, service providers, civil society, and school children. The on-farm trials conducted in various districts of Punjab and Haryana during 2019-20 and 2020-21 revealed that the Happy Seeder contributed to higher wheat yields (8% in Punjab and 10% in Haryana), good economic returns, and fuel savings of as much as 32 litres, over farmers' conventional practices.

A straw management system attached to this combine harvester shreds rice stubble, facilitating the direct sowing of wheat seed into unplowed soil and obviating the need to burn rice straw.

Direct sowing of wheat seed into a recently harvested rice field using the "Happy Seeder". A cost-effective and eco-friendly alternative to burning rice straw, in northern India.

SUSTAINABLE, SOLAR-POWERED IRRIGATION

In India, irrigation comes predominantly from groundwater extracted using millions of diesel pumps, and more than half the country's sown area depends solely on precipitation. Solar powered irrigation pumps can dramatically reduce costs and increase incomes, particularly for farmers, and there are already almost 230,000 solar irrigation pumps in India. India's Kisan Urja Suraksha Evam Utthan Mahaabhiyan (KUSUM) scheme and the Gujarat government's Suryashakti Kisan Yojana (SKY) are examples of initiatives to scale solar-powered irrigation, building on strong funding, government support through subsidies and loans, a mix of improved technical efficiency, and falling unit prices.

In parallel, BISA-CIMMYT and partners in India have documented the potential efficacy of drip irrigation for cropping in South Asia and proposed it as a resource-conserving alternative to flood irrigation, given the region's concerns with groundwater depletion as agriculture intensifies to feed a rising populace. With support from the German development agency GIZ, BISA organised 13 capacity-building events drawing more than 480 farmers and agricultural extension agents in 2021. Forty more events targeting some 1,200 agricultural extension workers from diverse government departments will take place, under this programme. The events target farm maintenance, cropping system management, sustainable agricultural practices, and solar-powered irrigation systems. It aims as well to reach farmers and extension personnel in rainfed, "off the grid" areas and generally reduces the dependence on external technical support.

Participants receive training on solar panel power systems at BISA reserach farm in Jabalpur, Madhya Pradesh.

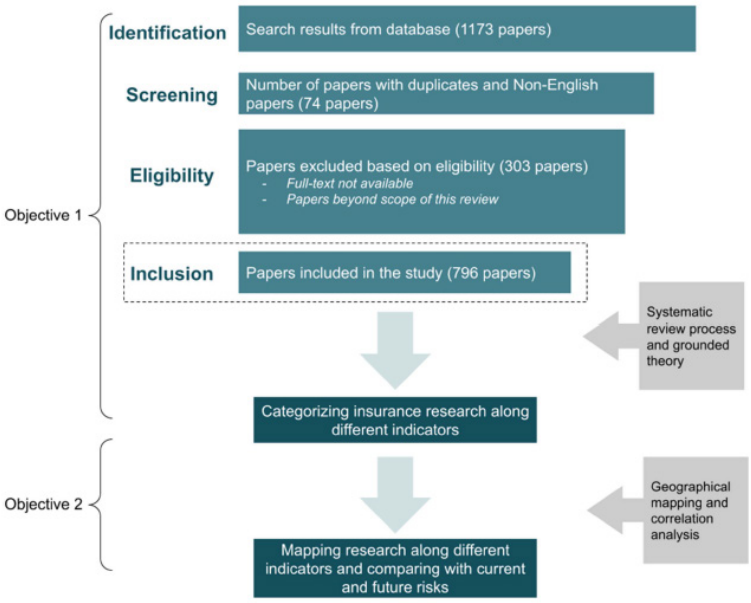
SPIS training participants pose for a group photograph after an interesting session at BISA research farm in Jabalpur, Madhya Pradesh.

MAPPING GLOBAL RESEARCH ON AGRICULTURAL INSURANCE

GOVERNMENTS, INSURANCE COMPANIES, AND RESEARCHERS NEED TO FOCUS ON RISK-PRONE AREAS AND INCLUDE NOVEL DEVELOPMENTS IN AGRICULTURE THAT WILL REQUIRE MAJOR INVESTMENTS AND INSURANCE, TO PLAY A RELEVANT ROLE IN CLIMATE CHANGE ADAPTATION.

Agricultural insurance plays a crucial role in supporting farmers and mitigating their risks and contributes to climate change adaptation by achieving Sustainable Development Goals (SDGs), including no poverty, zero hunger, and climate action. BISA specialists systematically reviewed 796 peer-reviewed papers on agricultural insurance published between 2000-19 to (1) categorize the literature by agricultural product insured, research theme, geographical study area, insurance type, and hazards covered, and (2) map the country-wise research intensity of these indicators vis-à-vis historical and projected risk and crisis events: extreme weather disasters, projected temperature increases under the SSP5 (Shared Socioeconomic Pathways) scenario, and livestock epidemics.

Schematic of the study



Insurance research focuses on high-income countries and crops are the chief agricultural product insured (33% of the papers). Production systems such as fruits and vegetables (South America), millets (Africa), and fisheries and aquaculture (southeast Asia) do not receive attention in the literature. Research on crop insurance occurs where weather disasters are frequent (correlation coefficient of 0.75). At the same time, we found a surprisingly low correlation between expected temperature increases and current research on crop insurance, even when sub-setting for papers on climate change and insurance. There is also limited evidence on the role of insurance to scale adaptation and mitigation measures that reduce farmers' risks. Research on livestock insurance is weakly correlated with disease epidemics but highly correlated with droughts and their frequency.

Crop insurance in South Asia is mainly done as index insurance (either yield or weather). The government of India is providing a comprehensive insurance cover against failure of the crop thus helping stabilize the farmers' income and encouraging them to adopt innovative practices. BISA has been working closely with various agencies involved in crop insurance in India. BISA's research on weather index insurance and tools for crop-loss assessment has proved useful to the insurance industry, farmers, and Governments in India.

QUALITY SEED PRODUCTION

High-quality seed is critical to boosting agricultural production. It helps ensure high rates of germination, strong seedlings, and good crop stands and can help to overcome poor soils, soilborne pathogens, and other unfavorable conditions.

In collaboration with ICAR, state governments, and other national partners in 2021, BISA facilitated the production, certification, processing, storage, and marketing of breeders, foundation, certified and Truthfully Labelled seed of new varieties of rice, wheat, maize, mung bean, pigeon pea, and mustard. This included about 10,000 tons of quality seed of wheat in the last decade. The truthfully Labelled seed is not been certified and is less expensive than other classes of seed, but like all other seeds, its purity, germination, and moisture status are tested and stated on the label. In 2021, BISA produced and disseminated total 11235.8 q seed of different crops to its stakeholders. It also included 9750 q seed of wheat.

BISA has helped develop and facilitate farmer seed grower associations and seed villages to make quality seed available at reasonable prices to farmers in Bihar, Madhya Pradesh, Maharashtra, and Punjab, linking such producers with state governments for certification and marketing. The Institute supplied breeder and foundation seeds to various public and private seed producers and trained their staff to develop their own capacity for quality seed production.

In year 2021, total 11235.8 q seed of different crops produced and disseminated to stakeholders including 9750 q quality seed of wheat.

DISTINGUISHED VISITORS TO BISA FARMS IN 2021

Australia's High Commissioner to India, Barry O' Farrell (left), observes the use of drone technology at the BISA experimental station in Ludhiana, Punjab.

Nitish Kumar, Chief Minister, Bihar during the virtual launch of Climate Resilient Agriculture (CRA) program in 38 districts of Bihar.

Shivraj Singh Chouhan, Chief Minister of Madhya Pradesh; and Jyotiraditya Scindia, Union Minister of Civil Aviation at Drone Mela in Madhya Pradesh. They interacted with BISA scientists and got to know more about drone technology and applications for agricultural research.

Trilochan Mohapatra, Secretary DARE & DG ICAR visited BISA farm in Samastipur, Bihar.

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million $ subsidy by the GOI for No Residue Burning in rice-wheat system

15,000
wheat genotypes evaluated using precision phenotyping and genomics

400
ha state-of-the-art farms established

10,000
kg ha^{-1} productivity achieved first time in Indian wheat trials

200
international stakeholders trained in advanced research

5,000
tons quality seed produced and distributed to stakeholders

200
research papers published in international journals

3,000
villages in India and Nepal transformed following the Climate Smart Village approach

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