Issue 34
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NEWSLETTER

Smart & Net-Zero Project

The Smart Net-Zero (SNZ) project team under the Food and Fertilizer Technology Center (FFTC) for the Asian and Pacific Region regularly collects and shares information related to sustainable agri-food systems and climate-smart agriculture, including research, news, policy, data and event updates around the world on the project website.

Overview

From Data to Seeds: How Smart Breeding Is Shaping Climate-Ready Agriculture

Traditional crop breeding has relied on visual assessment and statistical analysis, but increasing climate volatility and a global population projected to reach 9.7 billion by 2050 are pushing these approaches to their limits. This pressure is driving a shift toward "Breeding 4.0," where artificial intelligence, big data, and predictive analytics are used to anticipate crop performance before planting. As a result, phenotypic selection is giving way to "smart breeding," which integrates genomic, environmental, and phenotypic data to accelerate genetic gains under complex conditions. The featured review **Research** introduces the integrated genomic–enviromic prediction (iGEP) framework, emphasizing environmental information to better capture genotype–environment interactions. Complementary studies highlight a move toward prediction-driven breeding, using stochastic simulation, high-throughput phenotyping, and UAV-based deep learning to enable earlier, more reliable selection. Research on wheat further demonstrates the need for integrated "resilience packages" that address interacting biotic and abiotic stresses.

News highlights FAO and CGIAR initiatives that link smart breeding with on-farm verification and low-emission practices. **Policy** features FAO's 2025 land degradation assessment and Denmark's Crop Innovation Strategy 2030, positioning advanced plant breeding as a climate resilience lever. **Open Data** introduces the OECD Climate Policy Dashboard and Ireland's AgNav, supporting data-driven benchmarking and net-zero transitions.

Content

RESEARCH

01 THEME: ICT in Agrifood Sustainability

Smart breeding driven by big data, artificial intelligence, and integrated genomic-enviromic prediction

November 07, 2022 | Molecular Plant |

Introduction: Climate change and population growth necessitate a transition from traditional phenotypic selection to data-driven "smart breeding". A research team led by CIMMYT-China and the Chinese Academy of Agricultural Sciences review how big data analytics and artificial intelligence are transforming crop breeding through the integration of genomic and enviromic information. The paper introduces the integrated genomic–enviromic prediction (iGEP) framework, which links genetic, environmental, and management data to better capture genotype performance across diverse environments. Drawing on examples from maize, wheat, and rice, the review positions AI-driven prediction as a core component of future “smart breeding” systems.

Key findings: The study introduces iGEP as an extension of genomic selection, demonstrating that treating environmental components (E) with comparable dimensionality to genotypes (G) and phenotypes (P) improves prediction under strong genotype-by-environment (G×E) interactions. Across reviewed cases, incorporating biologically informed enviromic covariates—such as temperature, radiation, and water-stress indices—raises prediction accuracy by approximately 10–30% compared with genome-only models. The authors show that machine learning and deep learning approaches better capture non-linear and multi-layer biological relationships than linear regressions. When transcriptomic and metabolomic data are used as intermediate phenotypes, maize yield prediction accuracy increases from 0.159 (genomic selection alone) to 0.245. High-throughput phenotyping (HTP) and remote sensing further enable earlier, more cost-efficient selection.

Importantly, iGEP supports crop redesign at multiple scales. At the micro scale, it enables the redesign of genes, metabolic pathways, and regulatory networks underlying complex traits. At the macro scale, it informs the redesign of individuals, populations, and species, supporting concepts such as perennial crop development and virtual evaluation of genotypes in untested or future environments for climate-adaptive variety targeting. To address big-data challenges, the study emphasizes overcoming the curse of dimensionality through feature selection and dimensionality reduction, as well as the digitalization of breeders’ experiential knowledge via AI-assisted decision support. Transfer learning is identified as a key approach for extending iGEP to non-model crops with limited labeled data, while managing the “9 Vs” of breeding big data—volume, velocity, variety, and veracity among them—remains essential for translating smart breeding into sustained genetic gains.

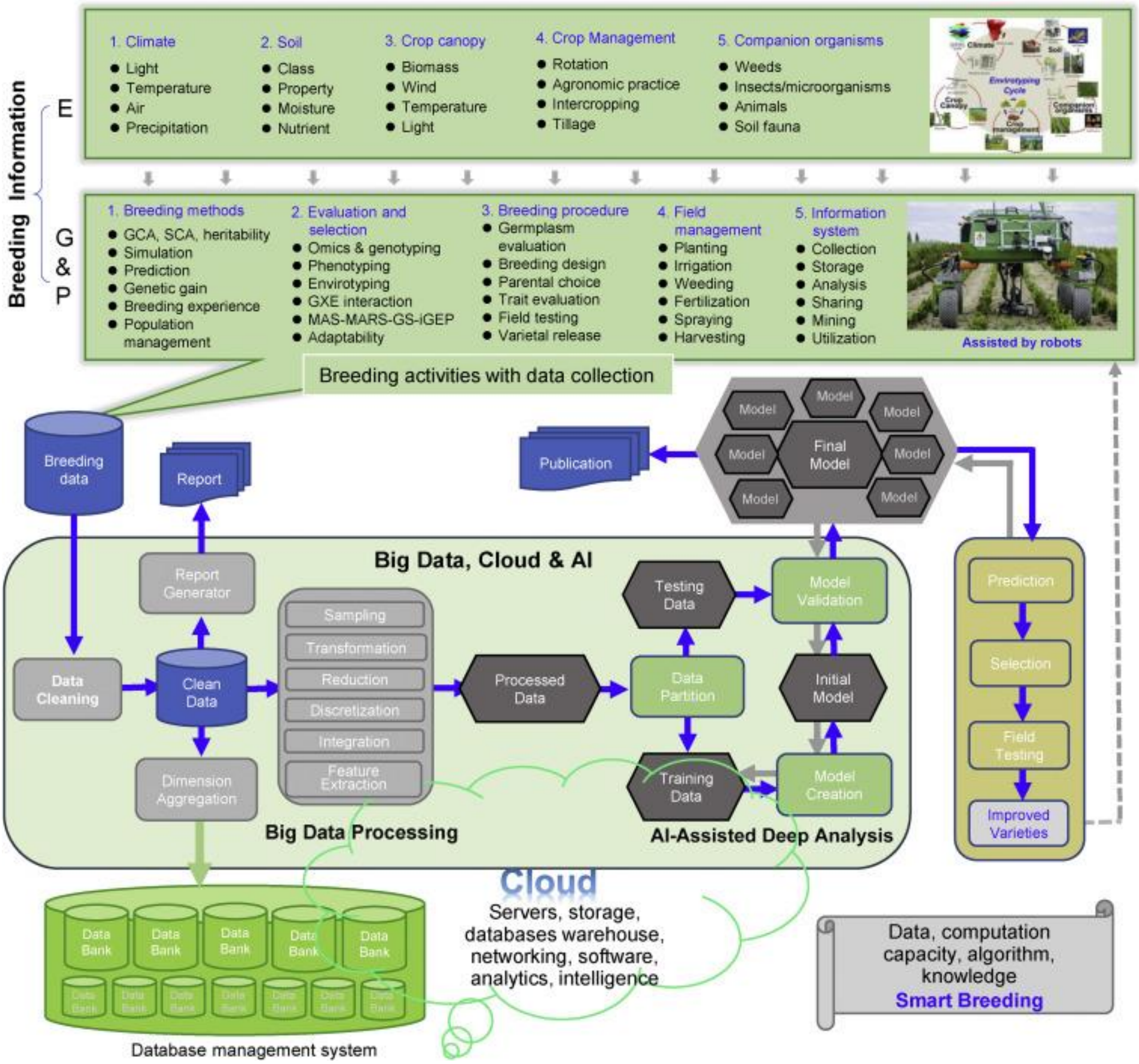


Figure | Overview of a system using big data and AI for smart breeding.
Data are collected for envirotype (E), genotype (G), and phenotype (P). Big data are stored, processed, and sampled to build and validate models with machine and deep learning and AI-assisted deep analyses. Trained models are used for phenotype prediction and selection to develop improved varieties. Smart breeding is driven by data, computational capacity, algorithms, and knowledge. GCA, general combining ability; SCA, specific combining ability; MAS, marker-assisted selection; MARS, marker-assisted recurrent selection; GS, genomic selection; iGEP, integrated genomic-enviromic prediction.

02 THEME: ICT in Agrifood Sustainability

Prediction-based breeding: Modern tools to optimize and reshape programs

October 09, 2025 | Crop Science |

Introduction: Traditional plant breeding often prioritizes explanatory models to understand biological mechanisms, which can limit the generalizability of selection decisions. Researchers from North Carolina State University (USA) and several Brazilian institutions address this gap by evaluating the shift toward prediction-based breeding. The study examines how tools like genomic selection (GS), high-throughput phenotyping (HTP), and enviromics can enhance genetic gain. Using a framework focused on operational utility, the authors review the role of stochastic simulations in optimizing breeding pipelines and reducing costs under dynamic agro-environmental scenarios.

Key findings: The review highlights a clear shift from explanation-oriented models toward prediction-driven breeding, arguing that for complex quantitative traits under climate variability, predictive reliability matters more than causal interpretation. Evidence synthesized across crops shows that prediction-based approaches—combining GE, stochastic simulation, HTP, and optimized trial design—can substantially increase genetic gain per unit time while reducing phenotyping costs. Simulation studies demonstrate that carefully designed training populations can achieve comparable prediction accuracy using only a small fraction of conventional field data, helping breeders anticipate overfitting risks before field deployment. The review further shows that integrating enviromics enables genotype recommendations across multiple environments by explicitly modeling genotype-by-environment (G×E) interactions through reaction norms. While advances in multi-omics and AI expand predictive power, the authors emphasize that data representativeness, environmental coverage, and institutional readiness—rather than model complexity alone—remain the main constraints to operationalizing prediction-based breeding for climate-resilient cultivar development.

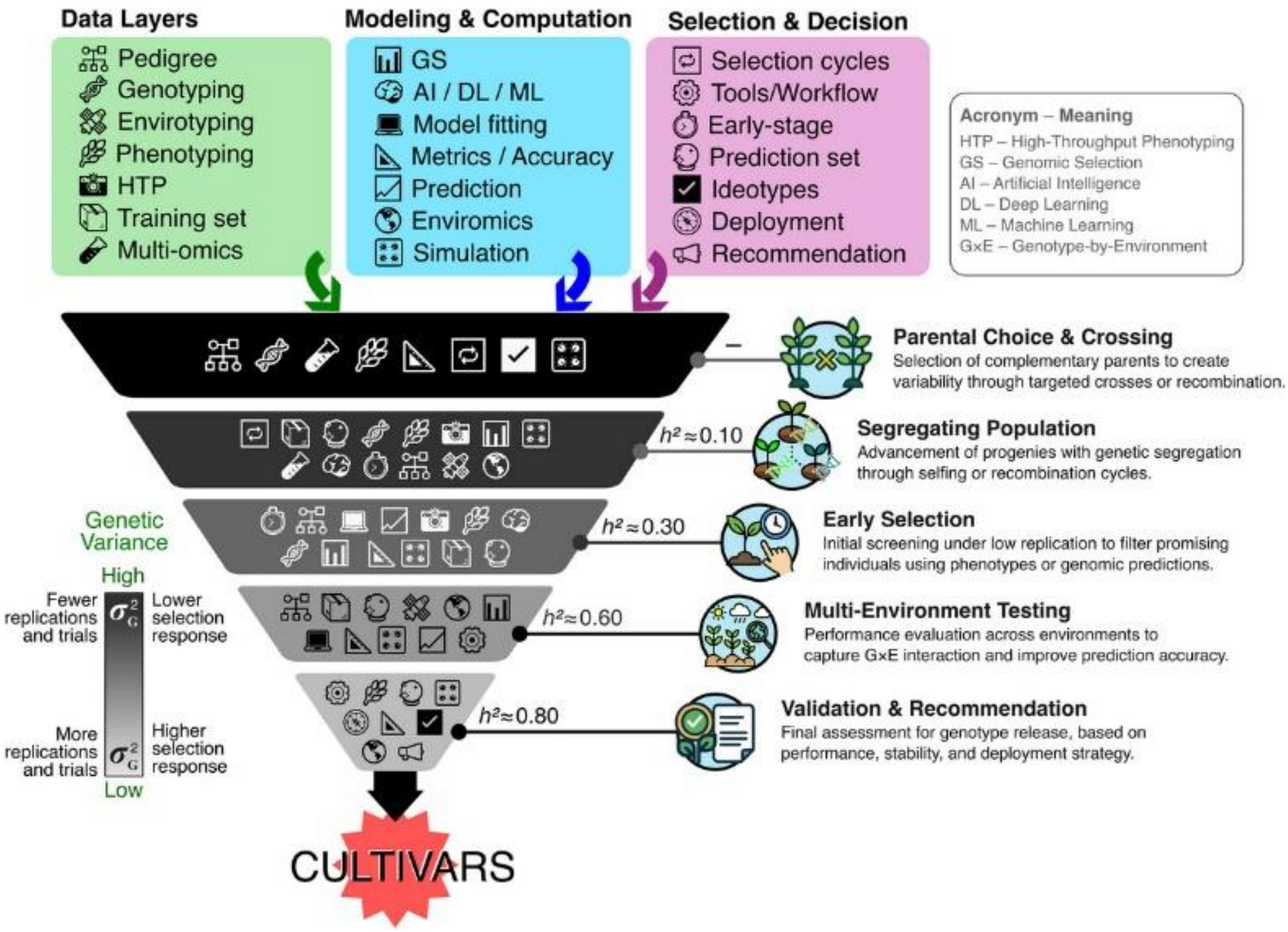


Figure | Funnel representation of the cultivar development pipeline and its main components (black and white flat icons inside each box). The five breeding stages are shown from top to bottom, illustrating the reduction in genetic variance (σ^2_G) and the increase in heritability (h2) across the selection process. Each stage is linked to specific data layers (green), modeling tools (blue), and decision-making components (purple), all represented by flat icons. Icons are placed according to their most frequent or practical use, although most components could operate across multiple stages. The scale on the left highlights the decline in genetic variability and the increase in trial intensity. The pipeline converges in cultivar deployment, guided by data-driven decisions.

03 THEME: ICT in Agrifood Sustainability

Climate change impacts on crop breeding: Targeting interacting biotic and abiotic stresses for wheat improvement

July 06, 2023 | The Plant Genome |

Introduction: Researchers from CIMMYT (Mexico) and Mamoré Research and Innovation (UK) address a critical gap in wheat breeding research: the limited consideration of interacting biotic and abiotic stresses under climate change. Under a predicted 2˚C global temperature increase, the timing and distribution of pests and diseases will shift, compounding the effects of drought and heat. Drawing on evidence from global wheat systems, the authors argue that most breeding programs still focus on single-stress tolerance, despite crops experiencing multiple, overlapping stresses in farmers' fields. The study seeks to align large-scale breeding data with omics tools to design future wheat ideotypes that integrate resilience with high productivity by combining physiological, genetic, and systems perspectives to propose new directions for climate-resilient wheat improvement.

Key findings: The study shows that interacting biotic and abiotic stresses—including heat, drought, nutrient limitation, elevated CO_2, and pests—reduce wheat yield and grain quality through non-linear physiological interactions that cannot be predicted from single-stress experiments. Combined heat and drought impair stomatal conductance, photosynthetic pigments, and source–sink balance, while elevated CO_2 may increase biomass but often reduces grain quality by raising the C:N ratio and lowering protein content. These effects are frequently amplified when abiotic stresses co-occur with diseases or insect pressure. The review highlights that recent advances in high-throughput phenotyping and machine learning enable more efficient characterization of these complex responses. Field-based models can predict stomatal conductance with up to 97% accuracy and radiation use efficiency (RUE) with around 69% accuracy, reducing field data collection time by up to 40-fold. Such tools support earlier selection and more realistic evaluation under field-relevant stress combinations.

Genetically, the authors illustrate how solid-stemmed wheat markers offer a dual benefit by increasing resistance to wheat stem sawfly while improving lodging resistance, demonstrating opportunities to address multiple constraints with single breeding targets. To accelerate progress, the study advocates open-access platforms integrating genomics, metabolomics, and proteomics, allowing breeders—especially in low-resource programs—to simulate thousands of genotypes across environments. Overall, the authors argue that shifting from isolated trait improvement toward integrated "resilience packages" is essential for delivering climate-adapted wheat and supporting a second Green Revolution grounded in sustainability and farmer benefit.

04 Theme: ICT in Agrifood Sustainability

Enviromic assembly increases accuracy and reduces costs of the genomic prediction for yield plasticity in maize

March, 2024 | Frontiers in Plant Science |

Introduction: Developing climate-smart agriculture requires cost-effective methods to characterize crop growing conditions. A research team from the Americas, led by the University of São Paulo (Brazil), addresses a key bottleneck in climate-smart breeding: the lack of widely adopted envirotyping pipelines that can both guide field-trial design and improve genomic prediction accuracy. Using tropical maize multi-environment trials in Brazil, the authors introduce an enviromic assembly–aided genomic prediction (E-GP) framework grounded in Shelford's Law of Tolerance. By translating raw environmental data into ecophysiologically meaningful typology markers, the study evaluates whether structured environmental information can improve the prediction of yield plasticity while substantially reducing the need for extensive in-field phenotyping.

Key findings: The study shows that E-GP consistently outperforms conventional genomic best linear unbiased prediction (GBLUP), particularly in predicting yield plasticity and performance in new or poorly characterized environments. In tropical maize trials, selective phenotyping guided by enviromic–genomic kinships achieved reliable predictions using only 1.5–4% of the original genotype–environment combinations. Incorporating enviromic assembly increased the accuracy of yield plasticity coefficients (b_1) by 437% ($r = 0.43$ versus $r = 0.08$ under GBLUP), while predictive ability for untested genotypes in nitrogen-limited environments was 118% higher than baseline models. Across scenarios, results demonstrate that the representativeness of genotype–environment combinations is more critical than the overall size of multi-environment trials (METs). By enabling accurate prediction with sharply reduced field phenotyping, enviromic assembly provides a parsimonious and biologically grounded platform for early screening of yield plasticity, offering regional breeding programs a cost-effective pathway to improve climate adaptability, particularly for resource-constrained breeding programs with limited capacity for extensive field trials or sensor-based envirotyping.

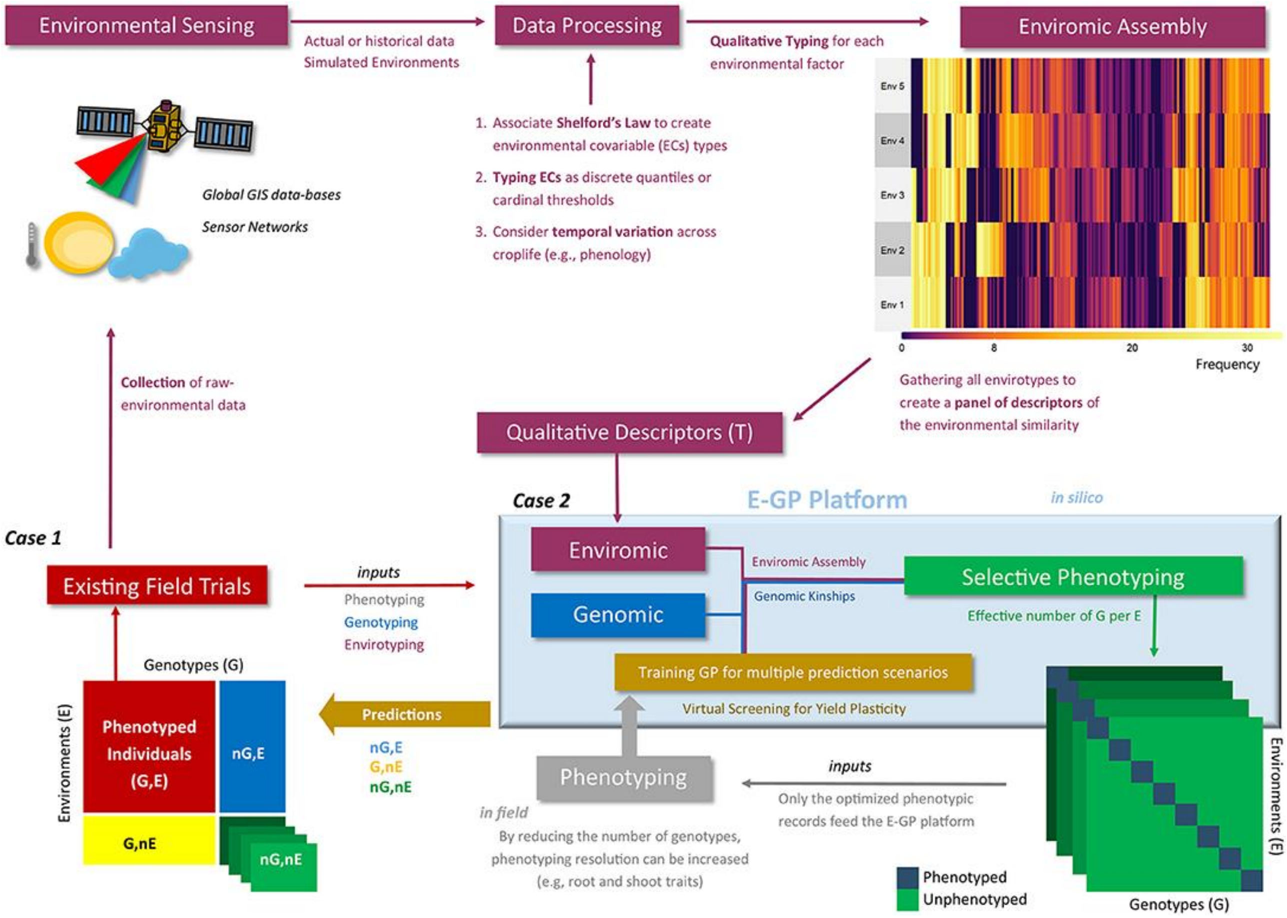


Figure | Workflow of the enviromic-aided genomic prediction (E-GP) considering the two study cases (Case 1 and Case 2) of this study.

Phenotypic records from existing field trials (red box) are based on observed genotypes (G) in tested growing environments (E). Currently, these data are being used for training prediction models considering untested genotypes at the same conditions (nG, E), especially when we have some type of structure of genetic relationships, such as genomic data (blue colors). In addition, novel growing conditions can be predicted (G, nE and nG, nE) using enviromic sources (wine colors), Case 1. First, raw environmental data are collected from trials involving equipment installed in situ (e.g., micro-weather stations) or remote sensing techniques. Then the raw data are processed and translated into an enviromic source that carries some ecophysiology process or statistical distribution of the raw data across time and space. The enviromic assembly is then finalized, in which its product is a matrix of envirotype markers by environments. Taking the T matrix as an example (qualitative descriptors based on typologies), a predictive breeding tool merging genomic, enviromics, and phenotypic data can be trained and deliver predictions for several scenarios of G × E. However, there is a second way to create an E-GP platform, the hereafter Case 2, in which the previously collected genomic and enviromic sources for a given TPE are used to develop in silico realizations of the expected G × E for a certain experimental network. Then, optimization algorithms are used to design a selective phenotyping strategy (green box) in which only the most representative genotype-environment combinations are phenotyped and considered for training the E-GP models (gray box). Finally, diverse G × E can also be predicted.

05 THEME: ICT in Agrifood Sustainability

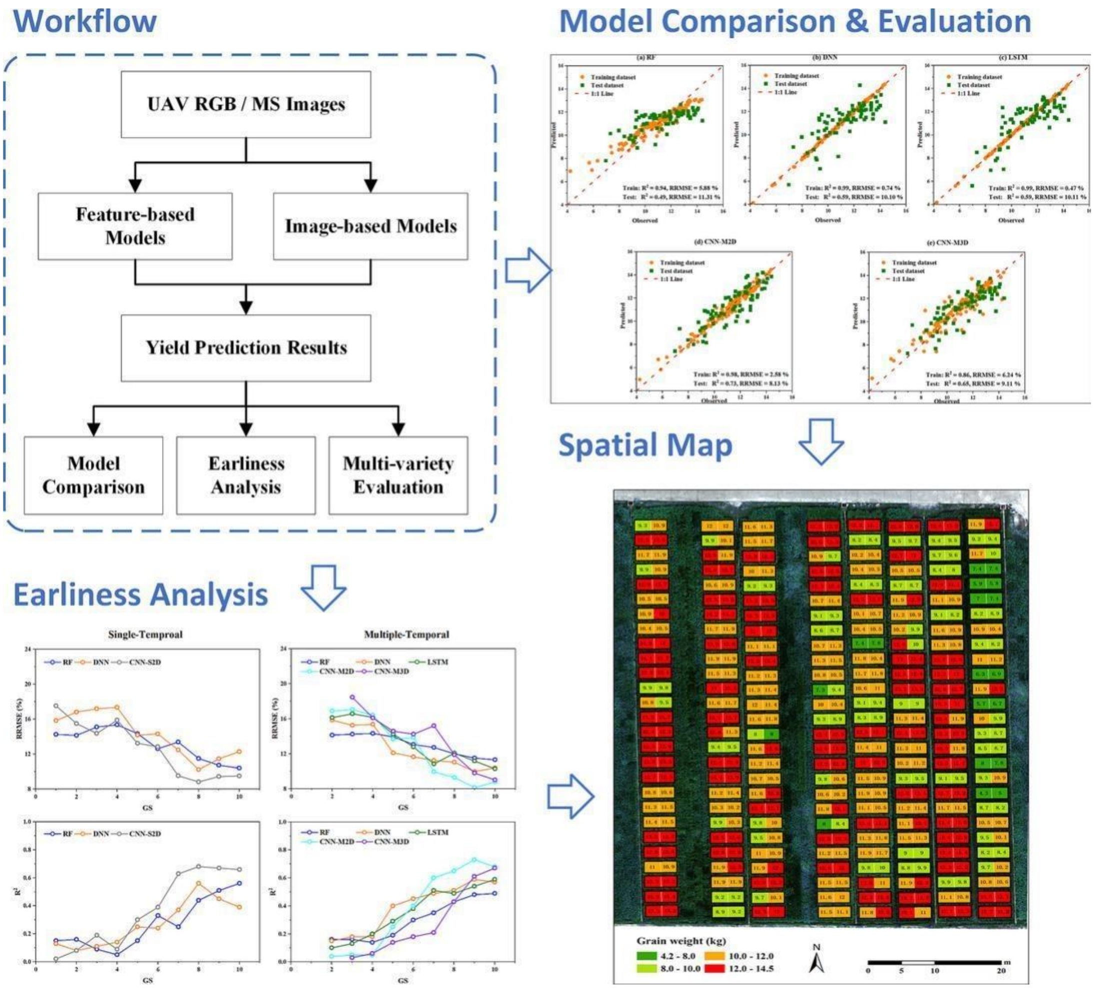
Yield prediction through UAV-based multispectral imaging and deep learning in rice breeding trials

February, 2025 | Agricultural Systems |

Introduction: Accurate and timely yield prediction is critical for breeding trials, as it enables early elimination of poor-performing varieties and accelerates selection decisions. Researchers from the Zhejiang Academy of Agricultural Sciences (China) report an empirical study conducted in eastern China that addresses a practical limitation in current breeding-oriented yield prediction: the lack of models that perform reliably across a large number of genetically diverse varieties. Using UAV-based multispectral imaging, the authors compare traditional feature-based machine learning approaches with image-based deep learning models across 216 hybrid rice varieties. The study aims to identify the optimal model architecture and prediction timing that can deliver high-precision yield estimates early enough to support large-scale breeding programs.

Key findings: Image-based deep learning models consistently outperformed handcrafted feature-based models, largely due to their ability to capture spatial information such as texture and canopy structure from multispectral images. Among the tested architectures, a multi-temporal two-dimensional convolutional neural network (CNN-M2D) achieved the best performance, with a relative root mean square error (RRMSE) of 8.13% and an R^2 of 0.73, demonstrating robust accuracy across genetically diverse rice varieties. Model performance improved as crops progressed through growth stages, with the optimal prediction window occurring from flowering to grain filling, corresponding to an ideal lead time of approximately one month before harvest. Stratified sampling further enhanced generalization by ensuring balanced representation of varietal categories during training, thereby reducing the mismatch between source and target domains when predicting yield across a large and diverse set of varieties. While image-based models required higher computational resources, they delivered more stable and consistent yield predictions across varieties. Overall, the study shows that UAV-based deep learning offers a practical high-throughput phenotyping approach to support earlier and more reliable selection in rice breeding trials, with potential applicability to other major crops.

Graphical abstract



NEWS

01 **THEME:** GHG Emission Reduction; Policy Incentives, Financing, Pricing

Four key pathways to transform agrifood systems and promote global food security

December 1, 2025 | Food and Agriculture Organization (FAO) |

Speaking at the opening of the 179th Session of the FAO Council, FAO Director-General outlined 4 pathways to accelerate agrifood system transformation amid rising climate risks and food insecurity. These pathways call for a shift from crisis response to resilience building, from input-intensive to knowledge-intensive systems, from siloed approaches to cross-sectoral synergies, and from global commitments to localized action. The agenda combines productivity, resilience, ecosystem restoration, and governance reforms with climate-smart agriculture, nature-based solutions, digital tools, and social protection to tackle agrifood systems' large emissions and climate vulnerability. Looking ahead, FAO signaled follow-up work under Brazil's COP30 Action Agenda, including leadership on the Resilient Agriculture Investment for Net-Zero Land Degradation initiative to translate global commitments into country-level action.

02 **THEME:** Policy Incentives, Financing, Pricing; GHG Emission Reduction

FAO-led projects to make agriculture resilient and sustainable in support of 1 million people

December 17, 2025 | Food and Agriculture Organization (FAO) |

FAO announced that the Global Environment Facility (GEF) approved a US$58.8 million package of 8 FAO-led projects spanning Bangladesh, DR Congo, India, Mexico, Senegal, Tanzania, and Ukraine. Designed to benefit over 1 million people, the projects will leverage about US$429 million in co-financing and target landscape-scale outcomes, including improved management of 305,000 hectare (ha) of protected areas, restoration of 314,000 ha of landscapes, and better management of 1.2 million ha of productive land. Key interventions include climate-smart crop and livestock systems, improved water management, and capacity building for smallholders and local institutions. The portfolio aims to bridge mitigation and adaptation by delivering productivity gains while reducing emissions intensity, and is expected to mitigate 84.5 million tonnes of GHG emissions, demonstrating how targeted finance and institutional support can translate global climate commitments into tangible agrifood outcomes, supported by strengthened monitoring frameworks for long-term resilience and impact.

03 **THEME:** ICT in Agrifood Sustainability

Mainstreaming on-farm verification in CGIAR breeding

December 19, 2025 | The Consortium of International Agricultural Research Centres (CGIAR) |

CGIAR reported progress in embedding on-farm verification trials (OFVT) as a standard final step in breeding pipelines, following a Nairobi convening of the Breeding for Tomorrow (B4T) Science Program, CGIAR and partner breeding teams, the 1000FARMS initiative, and the Gates Foundation. The approach is designed to close the gap between research-station performance and smallholder realities by generating late-stage evidence on how candidate varieties perform under farmers' practices and conditions—and which traits farmers actually value. B4T will coordinate shared protocols, manuals, and data integration so OFVT results can be consistently captured and compared across crops and regions, strengthening variety-release decisions and variety replacement efforts over time.

04 **THEME:** Policy Incentives, Financing, Pricing

Organic rulebook fit for the future

December 17, 2025 | European Commission |

The European Commission proposed targeted updates to the EU organic framework under Regulation (EU) 2018/848 to strengthen the sector's contribution to environmental sustainability and climate objectives while reducing administrative complexity. The revised approach clarifies production standards, certification procedures, and control mechanisms across member states, aligning organic farming more closely with the European Green Deal. It also addresses trade continuity by extending the validity of equivalence recognitions with 11 third countries beyond December 31, 2026, avoiding potential market disruption. The Commission estimates the amendments could deliver around EUR 47.8 million in annual direct administrative cost savings, primarily for farmers and operators. While highlighting organic farming's potential to reduce input use and enhance soil health and biodiversity, the update underscores the importance of robust implementation and monitoring, reaffirming the EU's commitment to scaling organic production as part of broader food system transformation.

05 **THEME:** MRV (Measurement, Reporting, Verification)

IRRI and VIETRISA unveil 'ViRiCert' for low-emission rice certification

December 18, 2025 | International Rice Research Institute (IRRI) |

IRRI and the Vietnam Rice Research and Development Institute (VIETRISA) jointly launched ViRiCert, a certification scheme recognizing low-emission rice production and supporting Vietnam's *"One Million Hectares of High-Quality, Low-Emission Rice*" program in the Mekong Delta. The scheme integrates field-level MRV with improved water and nutrient management, using standardized emissions benchmarks tailored to rice systems. As rice cultivation is a major source of methane emissions in Asia, ViRiCert links mitigation practices—such as **mid-season drainage** and **no burning of rice straw**—with digital compliance assessment, verification, and future labeling under a low-emission rice brand. The pilot implementation is planned across around 10 cooperatives, covering approximately 500 ha and targeting certification of about 20,000 tonnes of rice in the 2025–2026 winter–spring season. By connecting credible emissions data with certification, the initiative aims to improve farmers' access to green finance and premium markets, while pilot scheme will inform scaling across major rice-producing regions.

06 **THEME:** GHG Emission Reduction

Probiotic technology reduces rice field emissions as Yunlin County, Taiwan advances low-carbon farming with farmers and enterprises

December 18, 2025 | Yunlin County Government (In Chinese) |

Yunlin County Government announced the adoption of probiotic technology to reduce GHG emissions from paddy rice cultivation as part of its low-carbon agriculture initiative. The approach applies beneficial microorganisms to rice fields to improve soil conditions and suppress methane emissions during flooding periods, addressing rice cultivation as a major source of agricultural methane emissions in Taiwan. Implemented in collaboration with local farmers, agricultural cooperatives, private enterprises, and a research team from National Chung Hsing University, a 2-year field trial (0.6 ha) reported sharp annual emission reductions—methane (CH_4) down 81%, N_2O down 68%, and CO_2 down 77%—while rice yields increased by 1.8% in the first crop and 10.2% in the second. The initiative demonstrates a scalable, field-based mitigation pathway that integrates emission reduction technologies into conventional rice farming without compromising productivity, reflecting growing subnational engagement in climate-smart agriculture.

07 **Theme:** Policy Incentives, Financing, Pricing

AFA promotes domestic fresh fruit and carbon labeling to support sustainable agriculture in Taiwan

December 12, 2025 | Agriculture and Food Agency, Ministry of Agriculture, Taiwan (In Chinese) |

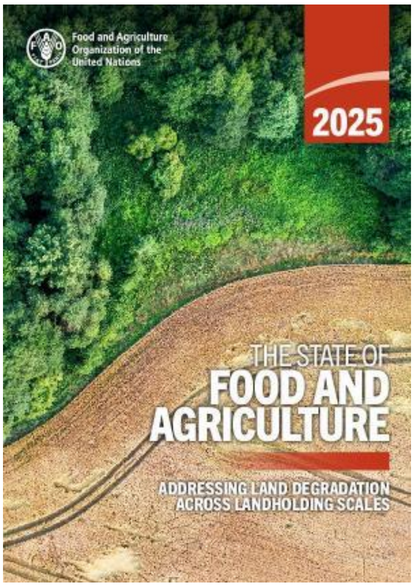
Taiwan's Agriculture and Food Agency (AFA) announced new efforts to promote domestic fresh fruit consumption through the introduction of carbon labeling, aiming to strengthen sustainable agriculture and consumer awareness. The initiative encourages producers and retailers to adopt product carbon footprint labels, providing consumers with transparent information on climate impacts while supporting domestic farmers and creating market-based incentives for low-emission production and supply-chain practices. A flagship case is a Taiwan banana product that received an official carbon footprint label—the first such application for bananas in Taiwan—developed with technical support from the Industrial Technology Research Institute (ITRI) and marketed through designated 7-ELEVEN retail channels. By linking consumption choices with climate performance, the policy seeks to stimulate demand for sustainably produced local fruit and reduce food system emissions, illustrating how pricing, labeling, and marketing can be aligned with climate objectives.

POLICY

01 THEME: Sustainable Production

The State of Food and Agriculture 2025 – Addressing Land Degradation Across Landholding Scales

Food and Agriculture Organization (FAO) | Source | Report |



FAO's 2025 flagship report provides a global assessment of how human-induced land degradation—linked to deforestation, overgrazing, and unsustainable farming—erodes ecosystem functions and agrifood productivity across countries at all income levels. It estimates that around 1.7 billion people live in areas facing sizeable degradation-related crop yield losses, with middle-income countries most affected. A central message is that landholding scale shapes both constraints and solutions: 85% of the world's ~570 million farms are <2 hectare (ha) yet cultivate 9% of farmland, while 0.1% (>1,000 ha) control nearly 50%—implying differentiated policy mixes for smallholders, medium farms, and large commercial operations. The report highlights that combining regulatory and incentive-based instruments, tailored to land conditions and farm structures, can best "avoid, reduce and reverse" degradation, supported by secure tenure, services, and inclusive financing.

02 THEME: Climate Smart Agriculture

Crop Innovation Denmark – CID Strategy 2030: Reducing Footprints – Improving Yield, Robustness, Quality, and Performance

Crop Innovation Denmark (CID) | Source | Report |

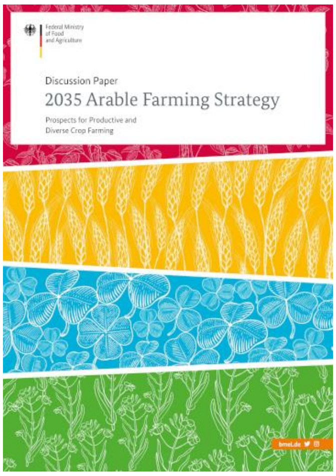
CID strategy 2030 sets out a coordinated public–private agenda to strengthen plant breeding as a foundation for climate-resilient and low-emission agriculture. The strategy aims to accelerate genetically based yield gains beyond the current ~1% annual trend by integrating advanced breeding methods with artificial intelligence, while improving crop robustness and quality under increasing climate stress. It identifies climate-driven risks—particularly the northward spread of pests and diseases in Northern Europe—as a key driver for innovation. Priority research areas focus on genome-to-phenotype understanding, including plant biologicals and genotype-by-environment interactions, alongside trait development for nutrient- and water-use efficiency, disease resistance, and lower emissions. A distinctive emphasis is placed on below-ground innovation, such as root system architecture, microbial interactions, and carbon sequestration, as well as quality traits that improve digestibility and reduce antinutritional factors. To enable delivery, CID calls for long-term funding for pre-breeding research and regulatory clarity for CRISPR/Cas technologies, positioning plant breeding as a central climate solution.

CROP INNOVATION DENMARK
- from genes to seeds

03 THEME: Sustainable Production; Climate Smart Agriculture

Germany 2035 Arable Farming Strategy: Prospects for Productive and Diverse Crop Farming

Federal Ministry of Agriculture, Food and Regional Identity (BMLEH) | Source | Report |



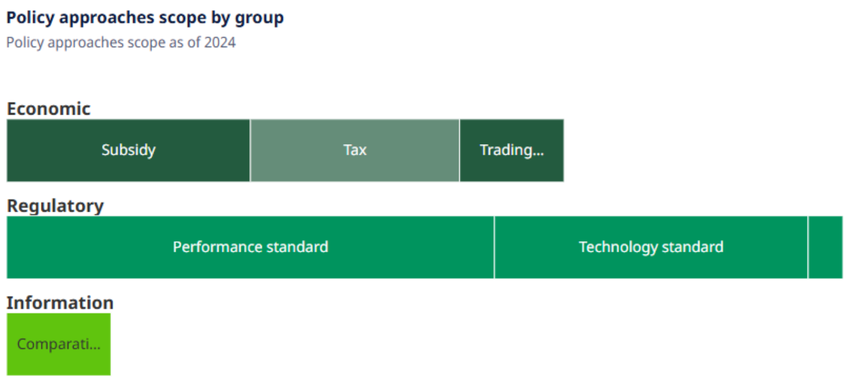
Germany's Strategy sets a long-term policy framework to sustain crop productivity while strengthening soil protection, biodiversity, climate mitigation, and digitalisation in arable farming. The strategy responds to rising land degradation risks, increasing competition for farmland, and climate pressures, while reaffirming food security as a core objective. It promotes diversified crop rotations, improved nutrient management, and precision agriculture, alongside a national target to reach 20% organic farming by 2030. Implementation is supported through targeted investment and funding programmes, including measures to encourage soil-friendly machinery, low-emission manure and fertiliser application, and research and development in plant breeding and nutrient efficiency. The strategy explicitly recognises that farm size shapes adoption capacity: smaller farms are encouraged to cooperate to access advanced technologies, while a nationwide network of demonstration "lead farms" is intended to support knowledge exchange and public engagement. Key challenges remain, notably rising land prices and regulatory uncertainty surrounding New Plant-Breeding Techniques (NBTs) following the European Court of Justice ruling, which the strategy identifies as a constraint on innovation.

OPEN DATA

01 THEME: Climate Action Plans and Programs; Climate Smart and Net Zero Toolkit

Climate Policy Dashboard

Organisation for Economic Co-operation and Development (OECD) | Database |



The OECD Climate Policy Dashboard provides a structured and comparable overview of climate mitigation policies under the Inclusive Forum on Carbon Mitigation Approaches (IFCMA). The first release compiles over 1,600 mitigation policy instruments and more than 10,000 policy sub-schemes, with fully validated data currently available for 38 countries, and broader coverage extending to 60 IFCMA participants. Policies are systematically classified using a standardized typology covering 3 instrument categories—economic, regulatory, information—organized into 7 groups and 43 policy approaches. Each instrument is described through harmonized attributes, including regulated agents (e.g. households or firms), targeted assets (such as fuels, equipment, or emissions), and policy intensity, enabling detailed cross-country comparison. While the dashboard primarily focuses on energy, transport, and buildings, it offers a transparent foundation for assessing policy mixes, benchmarking mitigation strategies, and examining coherence across sectors. The platform supports evidence-based policy learning and is expected to expand in coverage and analytical depth over time.

02 THEME: Climate Action Plans and Programs; GHG Emission Inventory

Zero Net Emissions Agriculture CRC, Australia

zne-ag CRC |

The Zero Net Emissions Agriculture Cooperative Research Centre (ZNE-Ag CRC) is a national, industry-led research partnership funded by the Australian Government's Cooperative Research Centres Programme together with industry and research partners. Its mission is to deliver practical, scalable solutions to achieve net-zero emissions in Australian agriculture while maintaining productivity and profitability. ZNE-Ag CRC operates through 4 integrated research programs, spanning low-emissions plant solutions and anti-methanogenic plant traits; technologies for methane-free cattle and sheep; whole-farm systems and GHG accounting; and enabling systems such as renewable energy (including agrivoltaics), circular economy approaches, and low-emissions supply-chain management. A central feature is its network of 25 Producer Demonstration Sites (PDS) across Australia, designed to test and de-risk innovations "in the paddock" under real farming conditions. Within this broader framework, ZNE-Ag CRC is developing Farm Greenhouse Accounting Framework (GAF) tools, a suite of sector-specific farm-level emissions calculators covering industries such as dairy, sheep and beef, cropping, feedlots, sugar, cotton, horticulture, pork, poultry, rice, buffalo, and deer. These tools are being released in phases through an online portal, with stakeholder feedback informing refinement. In parallel, the CRC supports high-impact innovation projects—including methane-reduction technologies for livestock and agrivoltaics trials—and dedicated programs for Indigenous engagement and workforce education to support long-term adoption of low-emissions agriculture.

03 THEME: Climate Smart and Net Zero Toolkit

AgNav Platform

AgNav |

AgNav is a farmer-centric sustainability platform designed to support on-farm decision-making through digital tools and data integration. It is a free, voluntary sustainability platform developed for Irish farmers by Bord Bia, Teagasc, and the Irish Cattle Breeding Federation (ICBF), with support from Ireland's Department of Agriculture, Food and the Marine, to help deliver national Climate Action Plan targets. Available for beef, dairy, and tillage systems, the platform follows an "Assess, Analyse, Act" workflow and integrates farm data from Bord Bia audits, ICBF animal and production records, and farmer surveys. AgNav calculates indicators such as greenhouse gas and ammonia emissions, nutrient balance, and soil carbon, and uses the AgNav Forecaster to translate these metrics into practical insights and bespoke on-farm action plans. By reducing manual data entry and linking performance metrics to management options, AgNav supports data-informed climate-smart decision-making, while its outputs remain bounded by predefined indicators and user-provided data.

EVENT

01

Environment & Climate Mobilities Network Conference 2026 (ECMN26)

June 23–26, 2026 | In-person | Wageningen, Netherlands |

ECMN26 is the fourth annual conference of the Environment & Climate Mobilities Network, held under the theme *"Mobilities and climate change: Bridging (trans)disciplinary, spatio-temporal and political divides."* The conference brings together researchers, policymakers, and practitioners to examine how climate change and environmental degradation shape human mobility, livelihoods, and rural–urban dynamics, with implications for food systems, agricultural resilience, and adaptation planning. Contributions are invited across 4 hematic pillars—**Politics; Inter- and transdisciplinary collaborations and methodologies; Land- and waterscapes; and Time**—including innovative sessions and workshops. The call explicitly welcomes emerging approaches such as AI-enabled analysis, nonhuman-centered methods, and decolonizing climate mobilities research. By integrating empirical evidence, governance perspectives, and methodological innovation, ECMN26 aims to inform future research agendas and policy dialogue on climate resilience in highly exposed agrifood and rural regions.

02

The 7th World Conference on Climate Change and Global Warming (CCGCONF 2026)

July 23–25, 2026 | Hybrid | Copenhagen, Denmark |

CCGCONF 2026 convenes researchers, practitioners, industry participants, and students to present and exchange research on climate science, global warming, and sustainability transitions. The conference covers a broad thematic scope, including climate mitigation and adaptation pathways across policy, energy systems, land use, and food systems. The program includes oral, poster, and virtual presentations, alongside sessions designed to encourage interdisciplinary dialogue and networking across regions and sectors. Multiple publication pathways are available, with abstracts published in an ISBN volume, conference papers assigned DOIs, and selected contributions eligible for journal publication. Key milestones include the abstract submission deadline of July 3, 2026, and the late registration deadline of July 14, 2026.

03

The 81st Soil and Water Conservation Society (SWCS) International Annual Conference

July 26-29, 2026 | In-person | St. Louis, Missouri, United States |

Held under the theme *"Gateway to Conservation,"* SWCS 2026 draws on St. Louis's location at the confluence of the Mississippi and Missouri rivers to highlight the expanding role of soil and water conservation in sustainable land management. The conference brings together farmers, conservation professionals, industry leaders, students, and researchers to exchange science-based practices that enhance resilience, support productive agriculture, and reduce environmental impacts under changing climate conditions. The program features specialty tracks such as **Regenerative Agriculture for All**, **Conservation at the Confluence**, and **Innovation, Technology, and Data in Conservation**, including an on-farm–oriented **"The Producer and the Plot"** format pairing producers and researchers. Technical sessions, workshops, and tours address soil health, watershed management, climate adaptation, and GHG reduction, with opportunities to develop contributions for the *Journal of Soil and Water Conservation (JSWC)*. Proposal submissions close on February 4, 2026.

04

The 7th International Conference on Agriculture, Food Security, and Food Safety

August 4–5, 2026 | Hybrid | Kuala Lumpur, Malaysia |

AgroFood 2026 will be held under the theme *"Strengthening Agri-Food Resilience: Technology, Safety and Sustainability in the Climate-Challenged World."* The conference brings together researchers, policymakers, practitioners, and stakeholders to share work spanning sustainable agriculture, food security, and food safety, with featured tracks including blockchain and supply chain transparency, bioengineering and AI applications in agrifood, and vertical farming and alternative proteins, alongside precision agriculture and food safety assurance. The program is designed to support both presentation and dissemination, with abstracts published in an ISBN volume and full papers appearing in DOI-assigned proceedings, as the conference timeline moves from abstract submission on February 17, 2026, to early registration closing on April 16, 2026.

05

The 23rd International Federation of Automatic Control World Congress (IFAC WC 2026)

August 23–28, 2026 | In-person | Busan, Republic of Korea |

IFAC WC 2026, the triennial flagship congress of IFAC, will convene control scientists, engineers, and students from around the world to exchange knowledge and advance applications of control and systems engineering. The program will feature plenary lectures, regular and invited technical sessions, workshops and tutorials, competitions, and industrial engagement activities, alongside multiple submission tracks for both research and applied contributions. While not sector-specific, the congress addresses core technologies—such as automation, robotics, and data-driven control—that underpin precision operations, autonomous systems, and energy-efficient processes relevant to smart and net-zero agrifood systems.