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Indonesia harnesses AI to fast-track chilli breeding and strengthen digital agriculture

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BRIN develops computer vision-powered platform to accelerate phenotype identification, improve seed certification and enhance food security through data-driven crop research

Indonesia is advancing its digital agriculture agenda with the development of an artificial intelligence (AI)-powered research platform designed to accelerate the identification of superior chilli varieties, a move expected to modernise plant breeding, strengthen seed quality assurance and support the country's long-term food security strategy.

The initiative, spearheaded by the National Research and Innovation Agency (BRIN), integrates artificial intelligence with computer vision technology to automate the analysis of chilli plant characteristics. By replacing laborious manual assessments with data-driven image analysis, researchers aim to significantly improve the speed, consistency and accuracy of phenotype identification—a critical process in crop improvement and seed development.

Developed by BRIN's Data Science and Information Research Center, the project represents a significant step towards embedding advanced digital technologies into Indonesia's agricultural research ecosystem. The agency believes the platform will streamline multiple stages of crop development, from breeding programmes and seed purity testing to variety certification and germplasm management.

Unlike conventional methods that rely heavily on visual inspections by plant breeders, the AI system applies deep learning algorithms to analyse leaf images and other morphological features, identifying subtle patterns that may be difficult or impossible to detect through manual observation. This enables researchers to characterise plant varieties more objectively while reducing variability in assessment outcomes.

According to Eka Prakasa, Head of BRIN's Data Science and Information Research Center, the technology has the potential to transform how agricultural institutions evaluate and develop improved crop varieties. By automating phenotype analysis, the platform is expected to shorten breeding cycles, enhance decision-making and improve operational efficiency for researchers, seed producers and regulatory agencies.

Beyond accelerating research, the technology is also expected to strengthen Indonesia's broader digital agriculture ecosystem by supporting higher seed productivity, improving competitiveness within the seed industry and contributing to national food security through evidence-based agricultural innovation.

BRIN researcher Wiwin Suwarningsih noted that the increasing demand for faster and more reliable plant identification methods is driving the adoption of AI across agricultural research. She emphasised that modern breeding programmes require scalable technologies capable of delivering consistent results to support plant variety protection, certification processes and the effective management of genetic resources.

The research team believes advances in deep learning have created new opportunities to automate phenotype identification with greater precision, producing standardised and reproducible assessments that can support large-scale breeding programmes and regulatory activities.

The initiative aligns with Indonesia's wider strategy to digitalise agriculture and leverage emerging technologies to improve productivity, sustainability and resilience across the food system. As policymakers increasingly promote innovation-led agricultural development, AI-enabled crop analysis is expected to play an expanding role in supporting scientific research, regulatory oversight and precision farming.

Automated phenotype identification could also help address longstanding challenges associated with manual evaluation, including inconsistencies between observers, longer assessment timelines and limited scalability. By generating reliable digital crop data, the system has the potential to improve transparency in certification processes while enabling more informed decision-making across public institutions and the seed industry.

Looking ahead, BRIN expects the AI platform to serve as a foundational technology for broader applications in plant breeding, seed testing and agricultural biotechnology. As Indonesia continues investing in digital transformation across its agricultural sector, initiatives such as this underscore the growing role of artificial intelligence in building more productive, resilient and technology-driven food systems.