Fast-forward breeding and rapid delivery systems for food security

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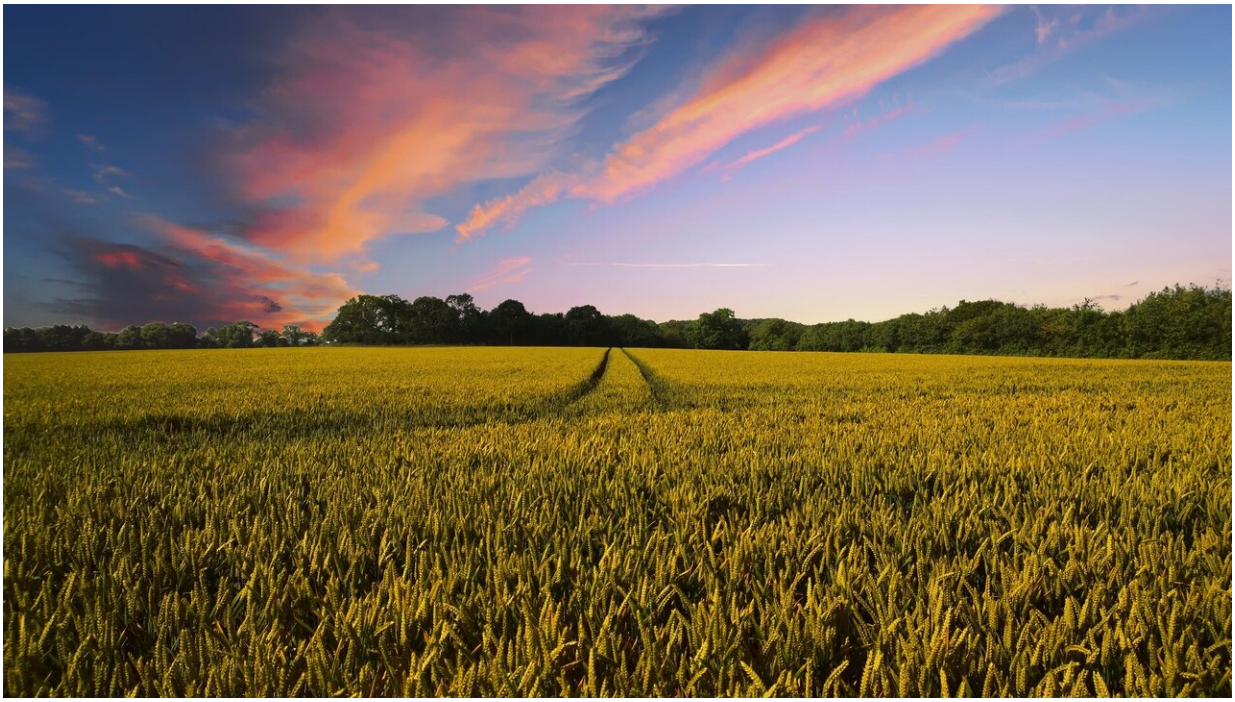

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The University of Western Australia's Institute of Agriculture has collaborated with international researchers to develop a roadmap to fast-forward breeding for accelerated crop improvement and rapid delivery systems, which will lead to a food-secure world.

Two papers, recently published in *Trends in Genetics* and *Nature*

Biotechnology, were the result of a Perth-based workshop organised by The UWA Institute of Agriculture and the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), and attended by research institutions from Australia, India, Austria, China, Mexico and the United Kingdom.

The current world population of 7.8 billion is predicted to reach 10 billion by 2057. Future access to affordable and healthy food will be challenging, with malnutrition already affecting one in three people worldwide. The papers recognized that global crop production systems need to expand their outputs sustainably to feed this rapidly growing human population.

The fast-forward breeding framework provided a strategy for integrating advanced technology in crop genome sequencing, phenotyping and systems biology, together with efficient trait mapping procedures and genomic prediction (including machine learning and artificial intelligence).

This would lead to establishing rapid delivery systems into global farming practices, which is required to achieve sustainable food security in the developing world.

Hackett Professor Kadambot Siddique, the Director of UWA Institute of Agriculture, worked with ICRISAT's Accelerated Crop Improvement Research Program Director and Adjunct Professor from UWA and Murdoch University, Rajeev Varshney, to develop the strategy and opinion papers.

"Realizing desired productivity gains in the field is imperative for securing an adequate future food supply for 10 billion people," Professor Siddique said.

"We need to establish and deploy rapid delivery systems to ensure farmers can access high quality seeds and appropriate agronomy packages."

Professor Varshney said increasing adoption of machine learning algorithms would provide valuable data about the genetic basis and molecular mechanisms of crops.

"This improved understanding is crucial to develop varieties faster," he said.

The fast-forward breeding framework demonstrated that emerging breeding approaches, such as optimal contribution selection (alone or in combination with genomic selection), would enhance the genetic base of breeding programs while accelerating genetic gains.

"Integrating speed breeding with new-age genomic breeding technologies could relieve the long-standing bottleneck of lengthy crop breeding cycles and contribute sustainable food security," Professor Varshney said.

More information: Rajeev K. Varshney et al, Fast-forward breeding for a food-secure world, *Trends in Genetics* (2021). DOI: 10.1016/j.tig.2021.08.002

Rajeev K. Varshney et al, Rapid delivery systems for future food security, *Nature Biotechnology* (2021). DOI: 10.1038/s41587-021-01079-z

Provided by International Crops Research Institute for the Semi-Arid Tropics (ICRISAT)

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