

AI can redesign plant DNA to futureproof food supply

An AI platform that can make plants more resistant to drought, disease and pests using small changes in plant DNA could help mitigate food security threats.

LONDON, UNITED KINGDOM,
December 10, 2024 /

EINPresswire.com/ -- An AI platform that can make plants more resistant to drought, disease and pests using small changes in plant DNA could unlock precision crop breeding and help mitigate food security threats.



Phytoform

Phytoform Lab's logo

With scientists searching for novel ways to face challenges in global food supply, the CRE.AI.TIVE™ platform, developed by [Phytoform Labs](#), offers a way to rapidly evolve sequences of plant DNA to activate traits such as drought and pest resistance.



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Nick Kral

While precision breeding tools like CRISPR-Cas promise to help address global challenges by enabling changes to DNA, in the world of plant breeding, it is essential to know which precise changes will make a significant impact. Direction on how best to use CRISPR is needed, and Jennifer Doudna, who won a Nobel Prize for co-inventing the approach, has suggested that combining AI and CRISPR

will be transformational in fields including agriculture.

"CRISPR is currently facing a bottleneck preventing it from delivering on its promise to help bring about better, more sustainable crops," says Dr Nicolas Kral, chief technology officer for Phytoform Labs, based at the Rothamsted Research site in the UK.

"Plants already have the genetic solution to stressors such as drought, but it's a case of switching on exactly the right part of the code. Until now, you didn't have a way to turn genes on in a scalable way. Existing methods took years and weren't always successful."

The company's foundation plant genomic model, [detailed in a paper published today](#) (10 December) on the pre-print platform [bioRxiv](#), was trained using the DNA sequences of 12 different crops, including corn, soybean and tomato, with no prior knowledge of areas which regulated plant traits or their locations.

The CRE.AI.TIVE model can predict gene activity from DNA, allowing the company to use the AI to comb through millions of sequences on a computer, identifying where slight changes can be made. This can be used to create DNA code to activate and tune genes, improving crop traits with no adverse effects on the plant. The company's scientists biologically validated the outputs of the AI in plant cells, changing target areas of a tomato gene involved in a drought response and turning it on.

"CRE.AI.TIVE has learned 'plant speak', the syntax and meaning of plant DNA, which means it can identify sequences that increase gene activity," says Dr Kral.

The technology has the potential to allow CRISPR-driven precision breeding to replace previous techniques such as GMOs, which can achieve desirable traits, but are prone to unintended negative effects. CRE.AI.TIVE is also able to learn from cultivar-specific data, meaning it can be applied to specific regions and farming use cases.

"CRISPR is great, but it's only as good as the changes that you are trying to make," says Dr Kral.

"If you identify a gene and its function, for example a gene for drought tolerance, that doesn't mean you have a commercial trait. You only have a trait if that gene is active in the right tissue at the right time. That's what this technology is offering, bringing a new level of control to plant breeding."



The CRE.AI.TIVE™ Platform, designed by Phytoform Labs, can restructure areas of DNA with large impact on crop traits



Phytoform founders Nick Kral and Will Pelton

Another current limitation to precision breeding is a lack of genomic data on plant species, and here too, the technology can play a role. CRE.AI.TIVE captures the diversity of plant genomics and uses species with more available data to make accurate predictions about those with less.

After proving the concept in plant cells, the next step is to show drought tolerance in plants. Phytoform Labs is now working with seed companies, with the aim of bringing the first AI-assisted, precision-bred crops to market within the next two years.

You can read the full paper, 'A scalable method for modulating plant gene expression using a multispecies genomic model and protoplast-based massively parallel reporter assay', on bioRxiv.

Nick Kral

Phytoform Labs

nicolas.kral@phytoformlabs.com

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