

OVEREXPRESSION STRATEGIES FOR IMPROVED PLANT TRAITS

Scientific publications often tend to overstate the potential impact of their findings. It is only rarely that such claims prove to be truly transformative—classic examples include PCR, CRISPR-Cas9, and RNA editing for vaccines.

A recent paper in Science (1) presents an elegant approach that enables (i) overexpression of a gene in plants and (ii) rapid testing of numerous variants.

How does it work

- A gene of interest is inserted into a geminivirus-based replicon.
- Once inside the plant cell, the replicon self-amplifies: many DNA copies are made, leading to strong expression of that gene (G) but only if G is functional!

That is:

- Replicon replication is engineered to depend on the activity of G:
- If G is expressed, it activates Rep leading to massive replication.
- If G is non-functional, Rep is not activated, leading to no replication.

Parallel testing in one leaf

- Through agroinfiltration, thousands of replicons carrying different variants are introduced into millions of leaf cells.
- Each cell becomes a micro-test chamber.

Selection and readout

- Functional variants replicate abundantly and dominate.
- Non-functional variants disappear.
- Deep sequencing reveals which variants have been enriched.

In this way, hundreds or thousands of variants of a resistance gene—or of a gene involved in protein, enzyme, or metabolite production—can be tested within just a few days in a single leaf.

Will this work really have a major impact on crop production? Let's wait and see.

1. <https://www.science.org/doi/10.1126/science.ady2167>