

Sequential development of plant breeding techniques

New generation plant breeding

TRADITIONAL METHOD

Crops with improved characteristics produced by cross breeding plants with desired gene



Gene has 50-50 chance of being passed to offspring. Desired gene will take multiple generations to spread

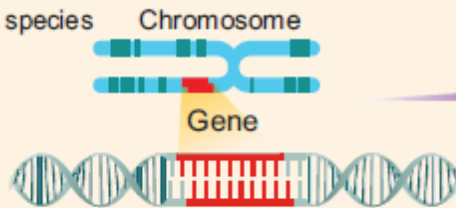
MODERN METHOD

Combines genes from different species



Bacteria
Bacterial chromosome

1. Plasmid:
Circular DNA molecule is removed from cell. This acts as **vector** to carry gene



2. DNA containing gene for desired trait is removed from chromosome. **Restriction enzyme** cuts gene from DNA



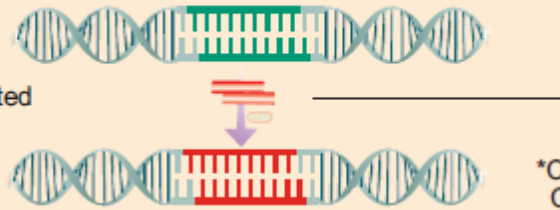
3. Vector: Restriction enzyme cleaves plasmid. Second enzyme – **DNA ligase** – pastes gene into DNA molecule, making **recombinant vector**



4. Vector inserts gene into chromosomes of plant cells

NEW BREEDING TECHNIQUES

Plant with desired gene has gene pasted into all its chromosomes. Gene is transmitted to nearly all offspring



CRISPR/Cas9*: Precise gene-editing cuts DNA at specified sequence and enables introduction of replacement sequence

*Clustered Regularly Interspaced Short Palindromic Repeats. Cas9 is a cleaving protein.