

How Crops are Genetically Modified

Traditional Breeding

Crossing plants and selecting offspring



Desired gene(s) inserted with other genetic material

Almost all crops

Mutagenesis

Exposing seeds to chemicals or radiation

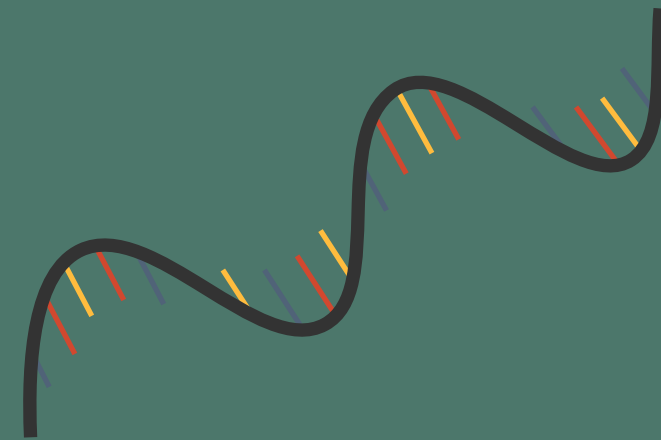


Random changes in genome, usually unpredictable



RNA Interference

Switching off selected genes with RNA



Targeted gene(s) switched off or 'silenced'

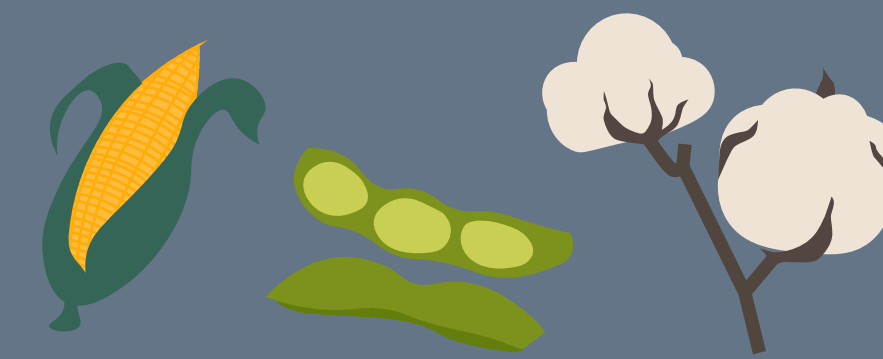


Transgenics

Inserting selected genes using recombinant DNA methods

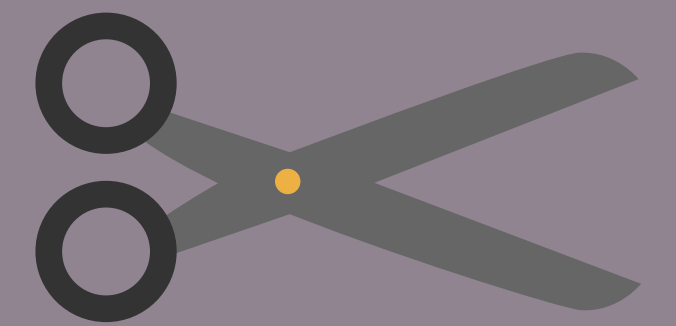


Only gene(s) inserted at desired locations selected



Gene Editing

When used to delete genes using engineered nucleases (CRISPR, TALENs, ZFNs, etc.)



Desired gene(s) deleted only at known locations



Number of genes affected:
few genes to whole genomes

100s - 1,000s

1 - dozens

1 - 8

1 or more

No safety testing required;
Unregulated

No safety testing required;
Unregulated

Safety testing required;
Highly regulated

Safety testing required;
Highly regulated

Safety testing required
depending on jurisdiction;
Mixed regulations

Undesirable, unintended effects rarely occur in the final product of any crop, regardless which process is used.