How Crops are Genetically Modified

<table>
<thead>
<tr>
<th>Traditional Breeding</th>
<th>Mutagenesis</th>
<th>RNA Interference</th>
<th>Transgenics</th>
<th>Gene Editing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crossing plants and selecting offspring</td>
<td>Exposing seeds to chemicals or radiation</td>
<td>Switching off selected genes with RNA</td>
<td>Inserting selected genes using recombinant DNA methods</td>
<td>When used to delete genes using engineered nucleases (CRISPR, TALENs, ZFNs, etc.)</td>
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<tr>
<td>Desired gene(s) inserted with other genetic material</td>
<td>Random changes in genome, usually unpredictable</td>
<td>Targeted gene(s) switched off or ‘silenced’</td>
<td>Only gene(s) inserted at desired locations selected</td>
<td>Desired gene(s) deleted only at known locations</td>
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<tr>
<td>Almost all crops</td>
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</tbody>
</table>

- **Number of genes affected:**
  - Few genes to whole genomes
  - 100s - 1,000s
  - 1 - dozens
  - 1 - 8
  - 1 or more

- **Safety testing required:**
  - 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.**